E-3.3 Noise Modeling Procedures

NIRS processes flight-track and operation data through several major steps: data integration and quality control, calculation of flight dynamics (thrust and speed), noise exposure computation, annualization of noise exposures, change of exposure analysis, and report generation. Key aspects of this processing are discussed below.

Model Input

The input for the NIRS modeling effort was developed in accordance with the data, sources, and methodologies presented in the previous sections. The input representing the average annual day of operations for the Future baseline conditions was fed to the NIRS model unchanged from the results described in the earlier sections. The input for each alternative was modified according to the MAP procedures designed for each alternative. Details relating to these modifications are present in subsequent sections of this appendix.

Data Integrity Checks

Before noise calculations are carried out, the NIRS pre-processor is run on all data components that contribute to the noise for a given annualized scenario. The resulting operation counts are checked against expected counts, and modeled fleet mix tables are reviewed for consistency with the noise modeling assumptions.

Profiles and operations were checked during the same pre-noise calculations, and profiles that violate the following rules were flagged:

Flag Type	Rule
Climb/Descent	No angles greater than 30 degrees
Altitude Controls	There must be at least one altitude set above ground level
Aircraft	Aircraft must be an INM profile aircraft type
Runways	Assigned runways must be longer than aircraft takeoff distance

Track/aircraft combinations with flagged profiles are rejected by NIRS prior to noise calculations. Elements of the input data that failed the above tests or that were not readable due to format errors were reviewed and modified.

Develop Output Reports for Impact Analysis

After all noise calculations are complete, NIRS is used to determine noise impacts by locating and categorizing changes in noise values between scenarios.

Using FAA scoring criteria, maps depicting zones of various types of change in annualized noise exposure between scenarios are produced within NIRS for the entire study area. In addition, two types of tables are produced that compare the changes in noise exposures across the study area, as follows:

Impact Table – Summarizes the distribution of population into DNL bands under two different scenarios, called Baseline (Future baseline) and Alternative. The function of the impact table is to compare the noise impacts due to these two different scenarios. This table is a spreadsheet showing how the population in the study area was distributed according to the values of the Baseline (Future baseline) and Alternative DNL exposures at each centroid. By considering a specific column corresponding to a certain exposure range under the Baseline (Future baseline) scenario, one can see how the distribution of exposures would change under the Alternative scenario for people in this Baseline exposure range. The results are aggregated into four bands for both Baseline (Future baseline) and Alternative (Proposed Action) DNL:

- < 45 DNL
- 45 to <60 DNL
- 60 to <65 DNL
- 65+ DNL

Impact Graph - Distribution of population with scoring criteria applied. This graph shows the distribution after the change of exposure scoring criteria has been applied. It also tabulates total increases and decreases above 65 DNL, total population above 65 DNL, and total population receiving increases or decreases. Later in this section, the construction and use of this graph is described, particularly with regard to tabulation of various aggregate measures.

The FAA scoring criteria is used to compare DNL changes at the population centroids in the study area. For each scenario, all population in the study area is divided into three categories: (1) those receiving an increase in noise exposure relative to the baseline; (2) those receiving a decrease; and (3) those having no change. The rules defining the increase, decrease, and no change categories and the sources for each rule are presented in **Table E-8**.

TABLE E-8 FAA SCORING CRITERIA

DNL Exposure	Minimum Change in Exposure	References
< 45 dB	Not readily detectable above ambient	Air Traffic Noise Screening Procedure EECP EIS[1/]
45 - < 50 dB	+ / - 5 DNL (Slight to Moderate)	As above
50 - < 55 dB	+ / - 5 DNL (Slight to Moderate)	As above
55 - < 60 dB	+ / - 5 DNL (Slight to Moderate)	As above
60 - < 65 dB	+ / - 3 DNL (Slight to Moderate)	FAA Order 1050.1E/FICON[2/]
>65 dB	+/- 1.5 DNL (Significant)	FAA Order 1050.1E/FICON

[1/] *Expanded East Coast Plan: Environmental Impact Statement.* Federal Aviation Administration. Washington, D.C. 1995.
[2/] *Federal Agency Review of Selected Airport Noise Analysis Issues*. Federal Interagency Committee on Noise. August 1992.

The impact graph is based on a comparative noise analysis where each population centroid has two noise exposure values associated with it: Baseline (Future baseline) exposure and Alternative exposure. Using Baseline exposure for the horizontal axis and Alternative exposure for the vertical axis, each centroid can be plotted at a specific location on the graph shown in **Exhibit E-9**. The scoring criteria define the zone of "no change" that gets progressively narrower as one moves from the upper left to the lower right on the graph. This narrowing reflects the tightening of the criteria from a 5.0 DNL threshold at lower exposures to a 1.5 DNL threshold at higher levels.

Several informative aggregate measures can be derived easily from the impact graph by summing population (and/or centroids) in specific regions of the graph. Referring to **Exhibit E-9**, and noting that change is described in terms of alternative exposure relative to baseline exposure, the following descriptions apply:

- Total population receiving "no change" - All population that falls in the central diagonal zone defined by the scoring criteria;
- Total population receiving a decrease - All population above and to the right of the "no-change" zone;
- Total population receiving an increase - All population below and to the left of the "no-change" zone;
- Total population above 65 DNL (Future baseline) - All population to the right of the vertical line denoting Baseline exposure of 65 dB;
- Total population above 65 DNL (Future baseline) receiving a decrease - All population in the green area;
- Total population above 65 DNL (Future baseline) receiving an increase - All population in the red area to the right of the vertical Baseline-exposure 65 dB line and below the "no-change" zone;
- Total population above 65 DNL (Alternative) - All population below the horizontal line denoting Alternative exposure of 65 DNL;
- Total population above 65 DNL (Alternative) receiving an increase. - All population in the red area;
- Total population receiving an increase to above 65 DNL with Baseline below 65 dB ("newly impacted") - All population in red area to the left of the "no-change" zone, and to the left of the vertical Baseline-exposure 65 DNL line.

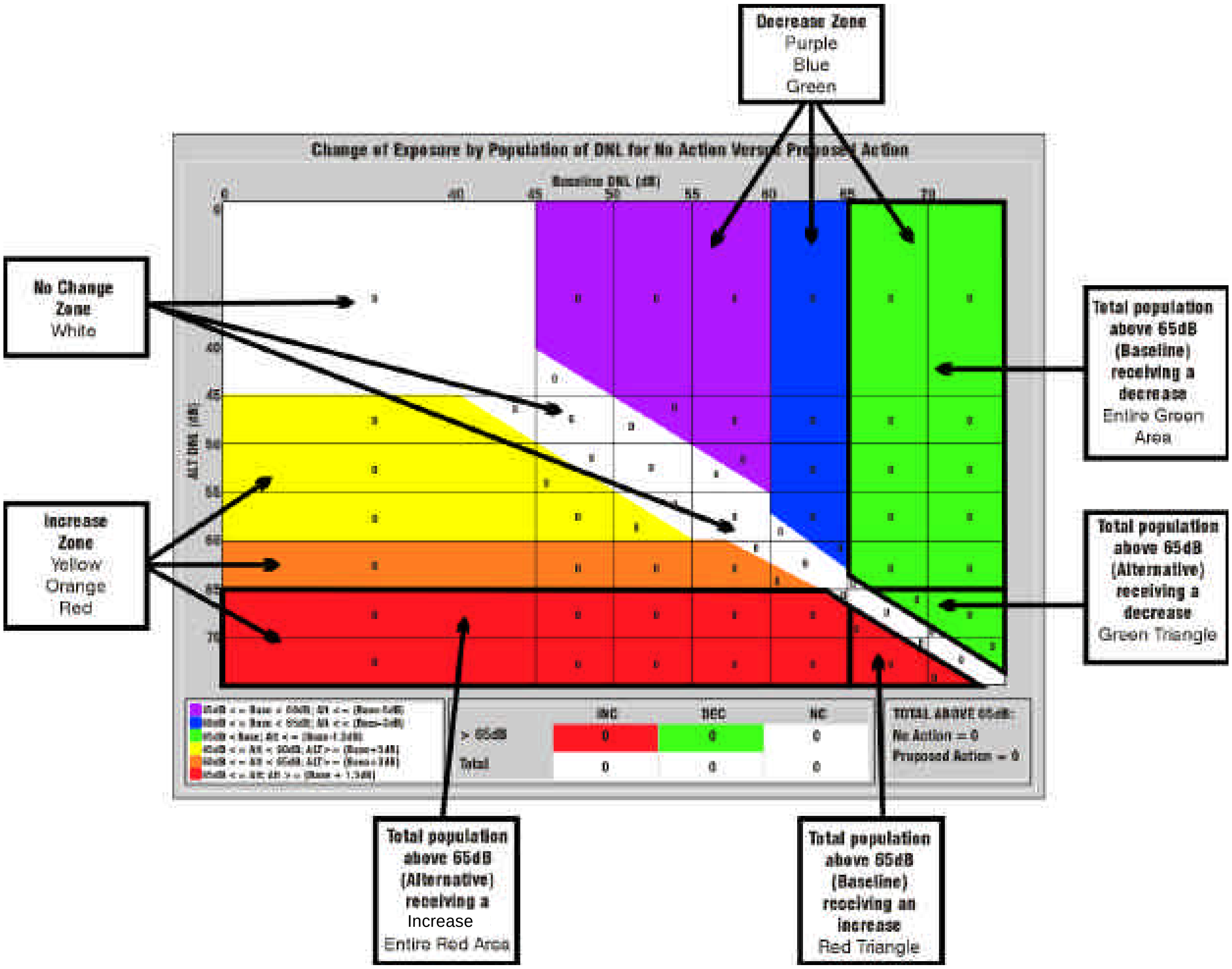


EXHIBIT E-9: IMPACT GRAPH AND MAJOR DESCRIPTORS OF CHANGE

E-4 NIRS ANALYSIS

NIRS model analysis was conducted for the Future baseline and each of the three MAP alternatives for the expected conditions in 2006 and 2013. Comparative noise impact results were tabulated for the Future baseline and each MAP Alternative at the previously described population centroids and supplemental grid points. Where zones of notable change occurred due to the alternative, an investigation of the cause of the change was conducted. The process of change investigation involved the following steps:

Step 1. *Zone Selection* – The zones to be investigated are selected. This normally includes all zones shown in an impact map, corresponding to all population in the color-highlighted regions of the impact graph.

Step 2. *Automated Analysis* – The NIRS Change Analysis tool is applied to the selected zones. This tool automatically compares all pairs of corresponding traffic files between scenarios to determine which file or files are the primary causes of the change of exposure associated with each zone. Since MAP traffic files are organized by airport, arrival/departure, and runway the cause can be identified down to the level of a group of tracks and associated events.

The Change Analysis tool retrieves centroid-specific data from the noise files derived from each traffic file and uses these noise values to determine the causative traffic files.

Step 3. *Manual Analysis* – A NIRS analyst further investigates the traffic data causing the change for each zone. Given specific pairs of causal traffic files, the analyst generates detailed maps of the tracks and the affected population centroids in each change zone, and identifies tracks and/or events that differ between scenarios. NIRS provides a graphical track query tool that enables the analyst to determine differences in track location, aircraft type, day/night event counts, runway utilization, and dispersion.

The following sections present both a summary of the NIRS model input modifications and the results of the noise analysis for each future scenario.

E-4.1 Future baseline

The Future baseline conditions for 2006 and 2013 were modeled in NIRS. For the purposes of this study, the Future baseline condition includes traffic using the new W1W runway that is currently under construction and expected to be open in 2006.

Future baseline Noise Model Input

For the Future baseline conditions the NIRS input was directly based on the data analysis presented in previous sections. Procedures for the new W1W runway were based on those modeled in the FAA's EIS for that project. No changes to the data analysis results were made beyond the inclusion of the new runway. With the exception of the operational levels, fleet mix, and city-pairs the model input for both 2006 and 2013 was the same.

Future baseline Noise Results

The NIRS noise analysis focuses on aircraft noise exposure in areas affected by DNL 45 and greater. **Table E-9** presents the maximum potential population exposed to noise by DNL ranges for the 2006 and 2013 Future baseline conditions. As the table indicates, approximately 740,000 people within the MAP study area are expected to be exposed to noise levels of 45 DNL and greater due to aircraft noise in 2006 if no design changes are made. By the year 2013, it is estimated that the population exposed to noise levels above 45 DNL will increase by 48,000 persons to just over 792,000 persons. The number of people exposed to noise of 65 DNL and greater is expected to increase by 652 people between 2006 and 2013 in the Future baseline scenario. These increases are partially due to the expected growth in aircraft operations in the area through 2013, and the associated increases in noise, and partially due to the forecast population growth in the MAP area through 2013.

TABLE E-9 FUTURE BASELINE MAXIMUM POTENTIAL POPULATION EXPOSED TO AIRCRAFT NOISE (45 DNL AND GREATER)

	Future baseline Population Exposure		
DNL Range	**2006**	**2013**	**% Change from 2006 to 2013**
45-60 DNL	698,688	745,615	6.7%
60-65 DNL	31,582	32,407	2.6%
65+ DNL	13,595	14,247	4.8%
Total Above 45 DNL	743,865	792,269	6.5%

Source: NIRS Analysis, Landrum & Brown/Metron Aviation Inc. 2005

Exhibit E-10 presents a map of the 2006 Future baseline noise exposure at the population centroids within the study area. The map is color coded based on the DNL noise level range that each centroid falls within. Areas that are exposed to noise below the FAA scoring criteria (less than 45 DNL) are indicated by the light purple coloring on the centroids. As the exhibit indicates, the noise levels due to air traffic throughout most of the study are below 45 DNL.

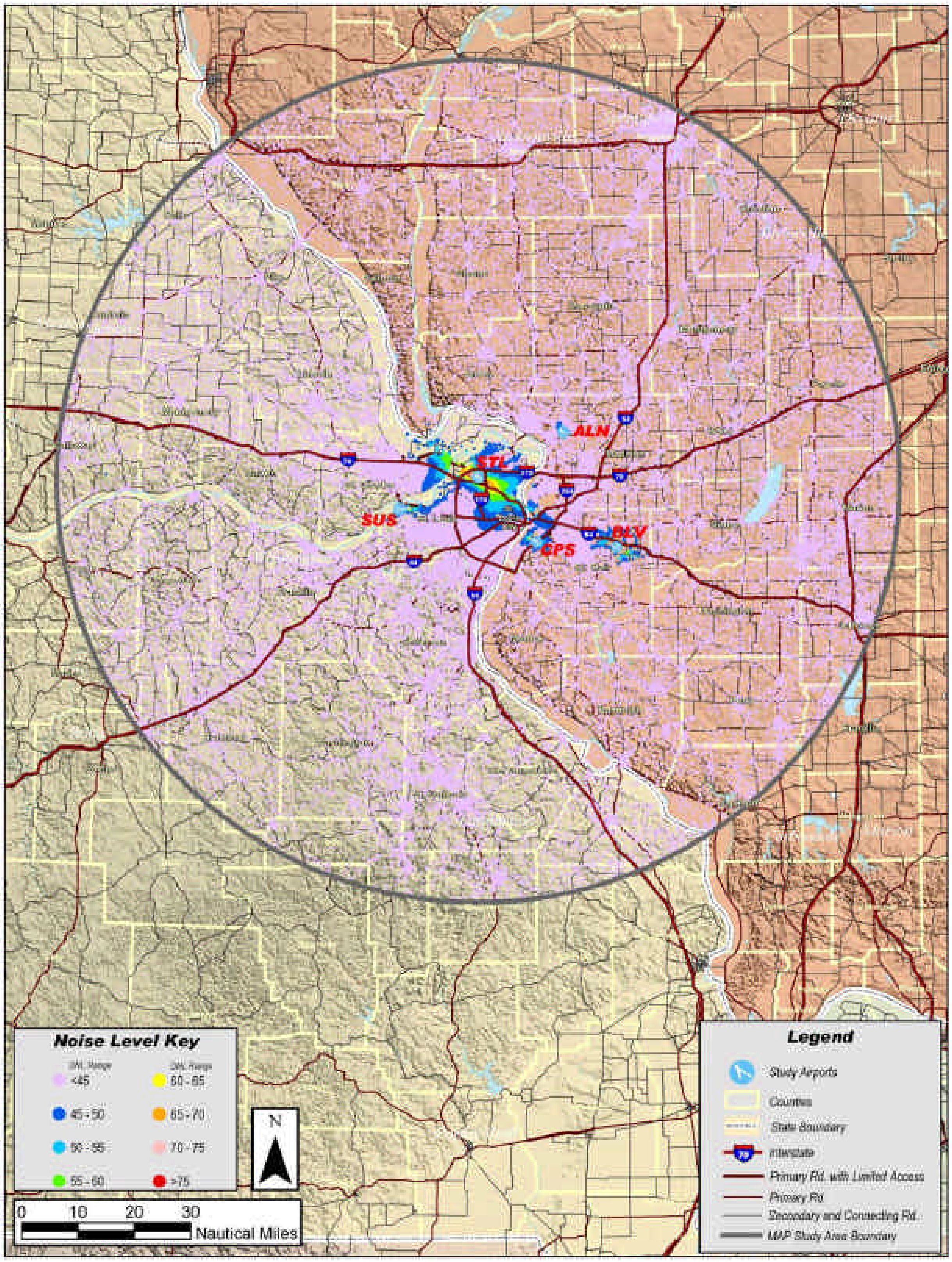


EXHIBIT E-10 - 2006 NOISE EXPOSURE AT POPULATION CENTROIDS

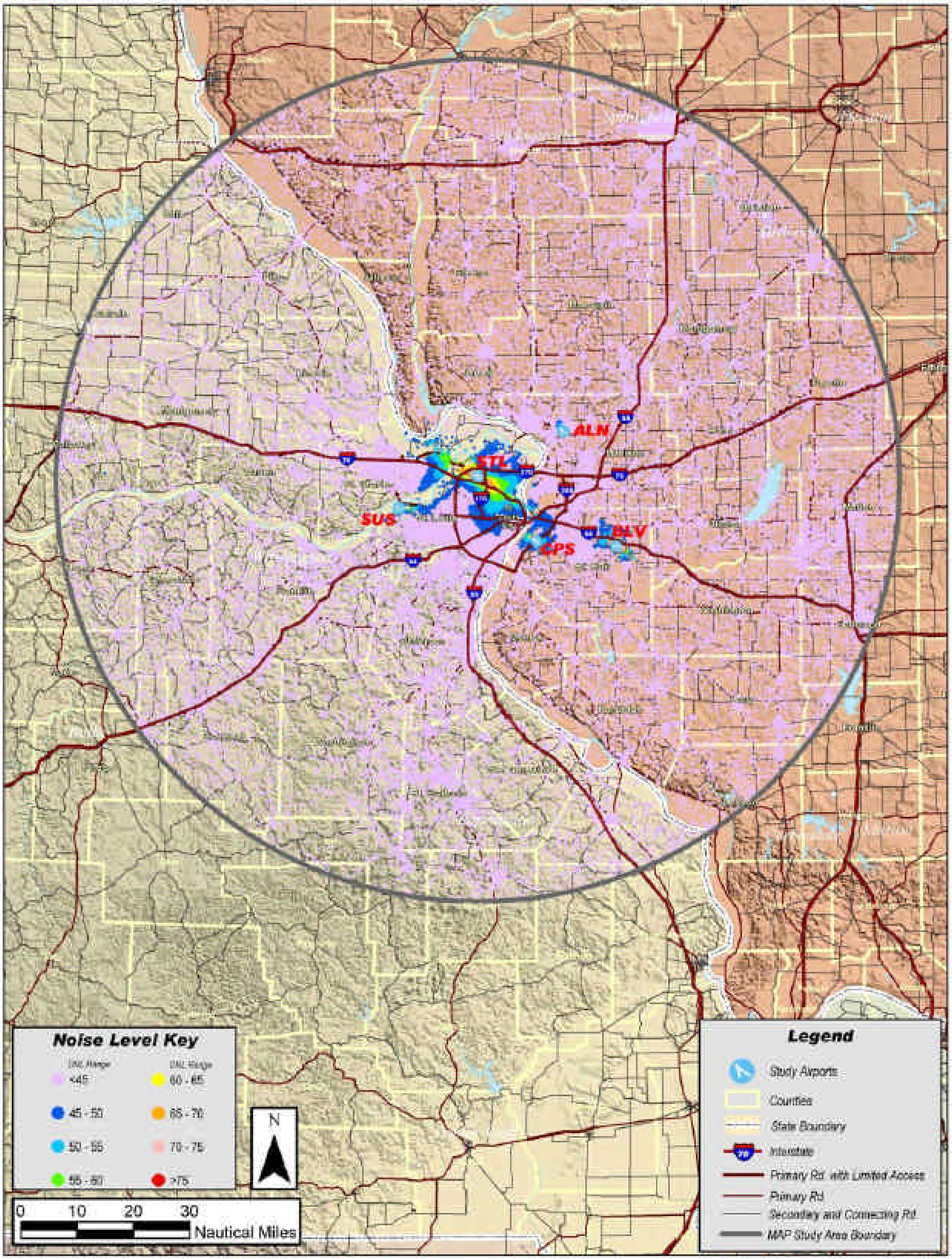


EXHIBIT E-11 2013 NOISE EXPOSURE AT POPULATION CENTROIDS

The higher noise levels indicated by the blue through red colors are concentrated in an area relatively close to each of the study airports.

A similar map is presented in **Exhibit E-11** for the 2013 Future baseline conditions. Again, the areas that are exposed to noise below the FAA scoring criteria (less than 45 DNL) are indicated by the light purple coloring on the centroids. As the exhibit indicates, the noise levels in 2013 are very similar to those shown for 2006. Only small changes are evident in the higher noise levels indicated by the blue through red colors that are still are concentrated in an area relatively close to each of the study airports.

E-4.2 Alternative 4A

The future Alternative 4A conditions for 2006 and 2013 were modeled in NIRS. Again, the Alternative 4A scenario includes traffic using the new W1W runway that is currently under construction, as well as the airspace design changes identified for the alternative.

Alternative 4A Noise Model Input

STL – Arrivals

Alternative 4A investigates the effects of moving STL arrivals into a true 4-corner post configuration. This configuration allows traffic to flow into the TRACON area at a 45° angle to STL runway alignment, creating maximum separation between arrival streams at the TRACON boundary. The detailed changes to the Future baseline arrivals are listed as follows:

- The northwest corner post for LORLE arrivals is shifted east approximately 14 nautical miles (NM).

- The southeast corner post for QBALL arrivals is shifted west approximately 5 NM

- The southwest corner post for KAYLA arrivals is shifted south approximately 7 NM.

Creating model inputs for the Alternative 4A arrivals involved moving streams of Future baseline arrival backbones so that they enter the TRACON via the corner posts of Alternative 4A. **Exhibit E-12** shows the STL Alternative 4A arrival backbones in red on top of the Future baseline backbones in blue. Yellow arrows indicate the movement of the Future baseline backbones into their Alternative 4A positions at the corner posts. As exhibited, the change in location for the corner posts requires movement of the backbones both upstream and downstream of the corner post itself. However, all Alternative 4A routing matches Future baseline routing within a 6 NM radius of STL.

STL – Departures

Alternative 4A affects STL departures in two ways. First, the shift of arrival streams necessitates an adjustment of some departure streams to meet traffic separation rules. This takes form in the removal of some departure gates and the addition of others. Second, some measures are taken in order to improve departure efficiency, such an increase in departure sectors from two to four. The detailed changes from Future baseline are as follows:

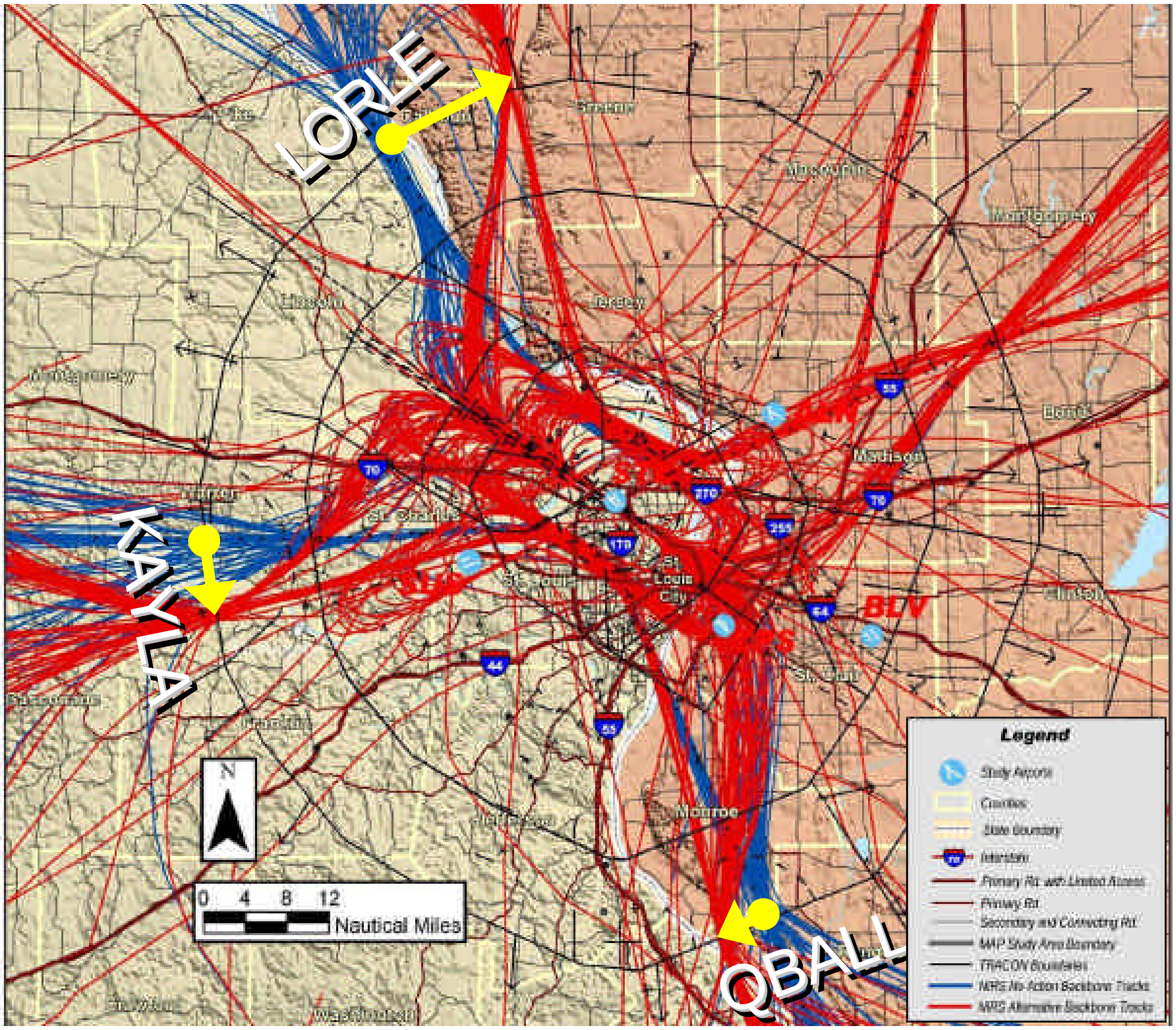


EXHIBIT E-12 ALTERNATIVE 4A ARRIVAL CHANGES - STL

- An air traffic control configuration with 4 departure sectors is implemented, instead of the 2 sectors of Future baseline. This scheme essentially creates a new set of boundaries for departures procedures. In east flow, the sector boundary changes substantially alter the routing of Cards and Gateway departures to the northeast. In west flow, the routing Lindbergh departures to the southwest are also altered. In the cases of Cards and Lindbergh departures, there is often a benefit to crossing the new sector boundaries early in order to allow a departure to climb unrestricted without the need to hold down until crossing under an arrival stream. This sector crossing procedure, referred to as a "zig-zag", will be allowed only through controller coordination when there is not a traffic conflict. It is assumed that 70% of Cards traffic and 80% of Lindbergh traffic will be allowed to zig-zag (i.e., cross sector boundaries), while the remaining traffic will be confined to its respective departure boundary.

- Two new departure fixes are added. The Ozark Kirksville fix to the northwest receives the traffic as stated above. The Ramms Naab fix to the east is a formalization of a shortcut route flown occasionally today. It receives the future baseline traffic flying the shortcut, and receives some traffic from the Gateway fix directly north of Ramms Naab.

- The Blues departure fix, to the southeast, moves south approximately 2.5 NM at the TRACON boundary. Additionally, in east flow, the entire procedure generally shifts southward to accommodate the new sector boundaries.

- Some propeller aircraft departures change initial headings. In east flow, prop departures to the southwest and northwest move from the Future baseline heading of 170° to a heading of 190°. In west flow departures to the northwest move from the south heading of 255° to the north heading of 350°.

Creating model inputs for Alternative 4A involved moving streams of Future baseline departure backbones, and redistributing traffic to new or changed departure routes. **Exhibit E-13** shows the east flow Alternative 4A departure backbones in red on top of top of the Future baseline departure backbones in blue. West flow departures are not depicted, but changes are mostly similar to those of east flow. Yellow arrows depict the general backbone movement or redistribution of traffic, and departure sector boundaries are shown in white. The two yellow arrows nearest the airport are showing moves made for sector boundary changes.

<u>Satellite – Arrivals</u>

Essentially, Alternative 4A affects satellite airport arrival flows in a way similar to the changes for STL. For those arrivals to satellites that enter the TRACON mixed with traffic flows to STL, the entrance gates are moved as necessary to match the STL changes. Most satellite arrival traffic flows do not enter the TRACON mixed with STL traffic. These flows are unaffected by Alternative 4A. The changes from Future baseline are detailed as follows:

- Some ALN and CPS traffic entering the TRACON area from the northwest will be moved eastward to fly over the fix MUZUL.

- Some CPS traffic entering the TRACON area from the south will be moved east or west to consolidate over the fix ESSAR.

<u>Satellite – Departures</u>

Departures from satellites are not affected as extensively by alternative 4A as were the departures from STL. The only changes are the addition of departure gates directly related to the gate changes for STL. These are as follows:

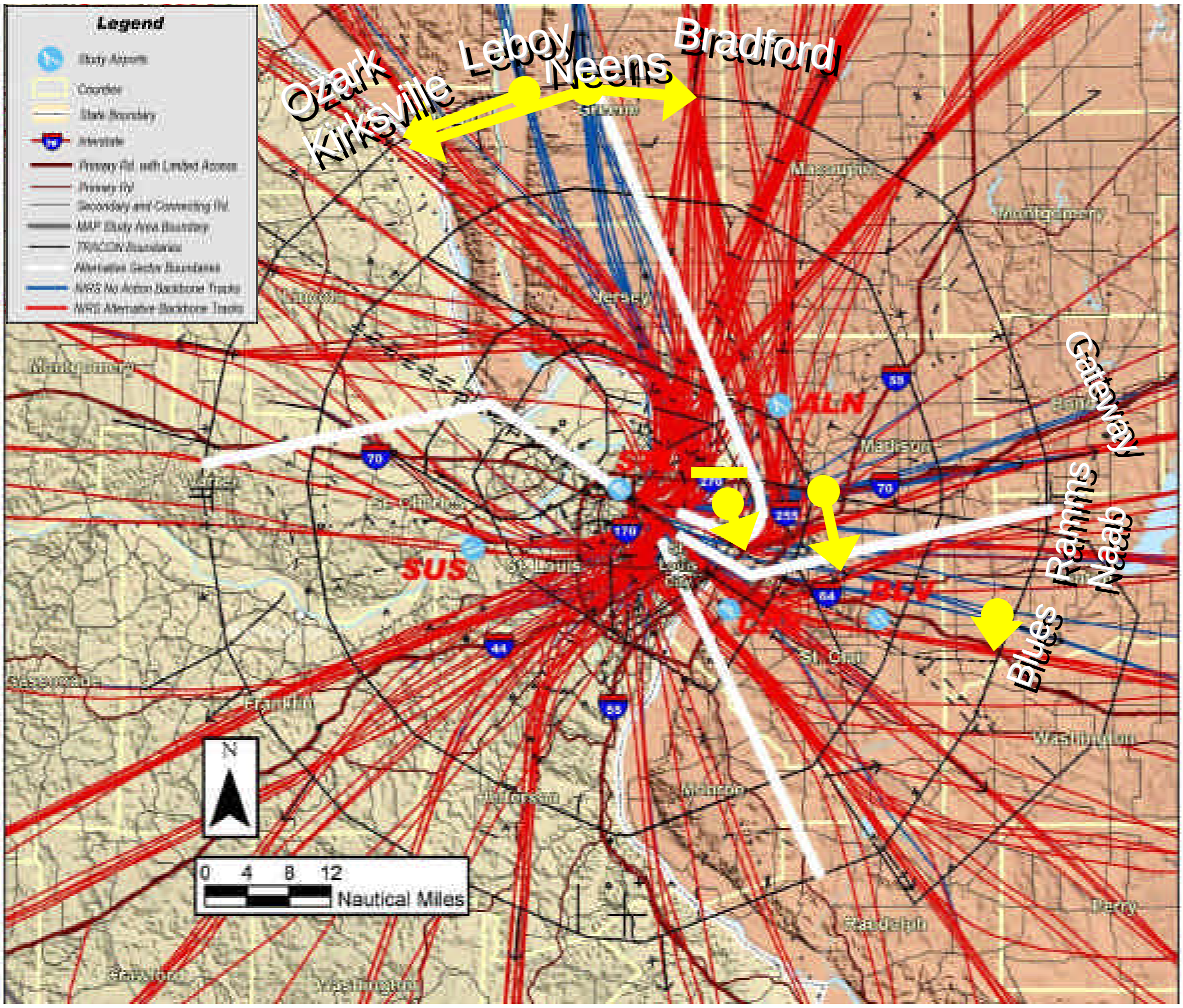


EXHIBIT E-13 ALTERNATIVE 4A DEPARTURE CHANGES - STL

- OZKIR is a new gate in the northwest for BLV and SUS.

- FARMR is a new gate in the northwest for CPS.

- RAAMS is a new gate in the east for CPS and SUS.

- BLUES gate moves southward for departures from SUS.

Alternative 4A Noise Results

The NIRS noise analysis for the alternatives focuses on the changes in aircraft noise exposure that the alternative creates with respect to the Future baseline condition. The route and procedural changes associated with Alternative 4A result in an additional 45,981 persons expected to be exposed to noise levels of 45 DNL or greater in 2006. By 2013, Alternative 4A is only expected to increase the estimated people exposed to aircraft noise above 45 DNL by 30,929 persons over the Future baseline conditions. Within 65 DNL and greater, a population decrease of 60 people is expected from the alternative in 2006 with a larger decrease of 364 people evident in 2013. The analysis details indicate that some 86 percent of the population exposed to aircraft noise of 45 DNL or greater would experience similar (less than 1 DNL change) or decreased noise levels throughout the study area with Alternative 4A in 2006. That percentage increases to some 88 percent by 2013. **Table E-10** presents a summary of the population exposed to noise levels for Alternative 4A as compared to the Future baseline scenario for both future years. The table highlights the areas where the alternative caused increases in population exposure for the specific DNL ranges as well as the decreases.

TABLE E-10 MAXIMUM POTENTIAL POPULATION CHANGE - ALTERNATIVE 4A

	Increase		No Change		Decrease
		2006 Future Baseline			
	DNL (dBA)	<45	45-60	60-65	>65	Alternative
2006 Alternative	<45	2,703,274	35,787	0	0	2,739,061
	45-60	81,768	661,663	1,627	0	745,058
	60-65	0	1,238	29,581	434	31,253
	>65	0	0	374	13,161	13,535
	Future baseline Total	2,785,042	698,688	31,582	13,595	3,528,907
		2013 Future baseline				
	DNL (dBA)	<45	45-60	60-65	>65	Alternative
2013 Alternative	<45	2,762,402	42,357	0	0	2,804,759
	45-60	73,286	702,136	1,519	0	776,941
	60-65	0	1,122	30,654	598	32,374
	>65	0	0	234	13,649	13,883
	Future baseline Total	2,835,688	745,615	32,407	14,247	3,627,957

Source: NIRS Analysis, Landrum & Brown/Metron Aviation Inc. 2005

In order to determine the changes in noise exposure associated with Alternative 4A, an analysis of the changes relative to FAA's noise impact criteria was done. Exhibit E-14 presents the NIRS impact graph based on the FAA scoring criteria for the 2006 conditions. Similarly, Exhibit E-15 presents the Alternative 4A impact graph for the 2013 conditions

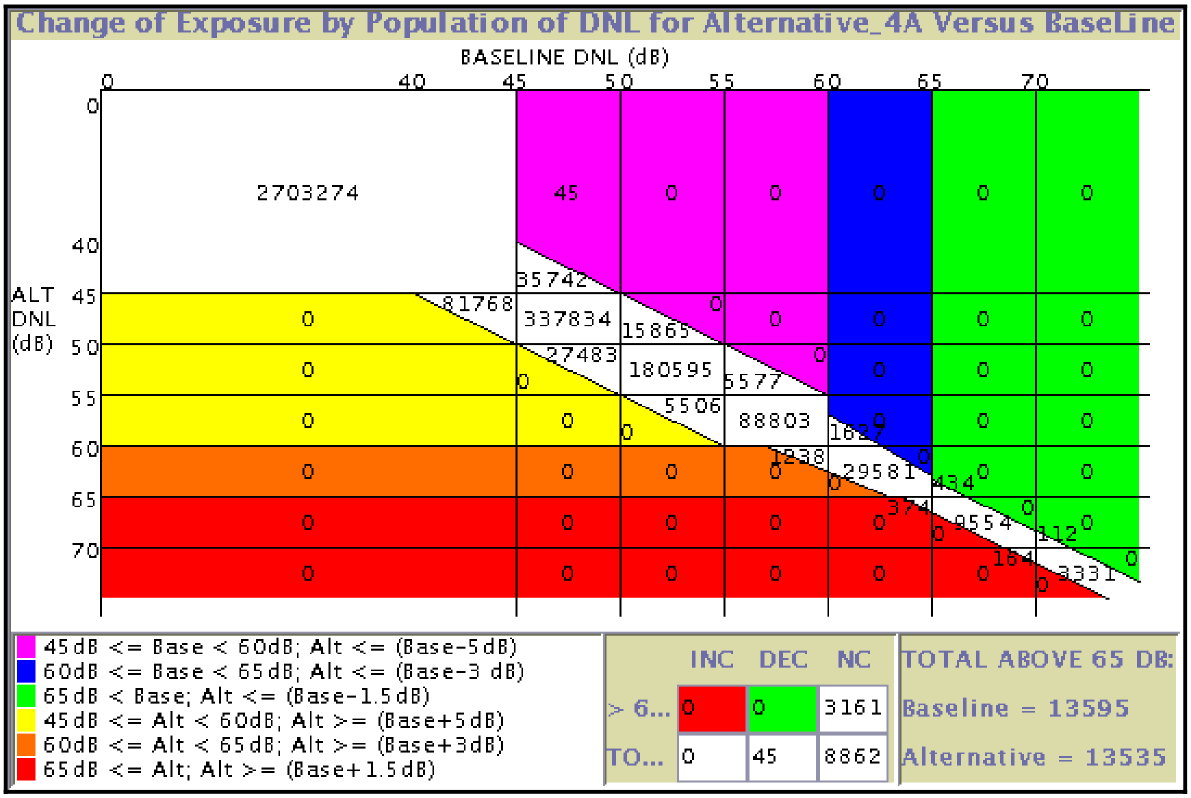


EXHIBIT E-14 NIRS IMPACT GRAPH ALTERNATIVE 4A 2006
(SEE EXHIBIT E-9 FOR DESCRIPTION OF FIGURE FORMAT)

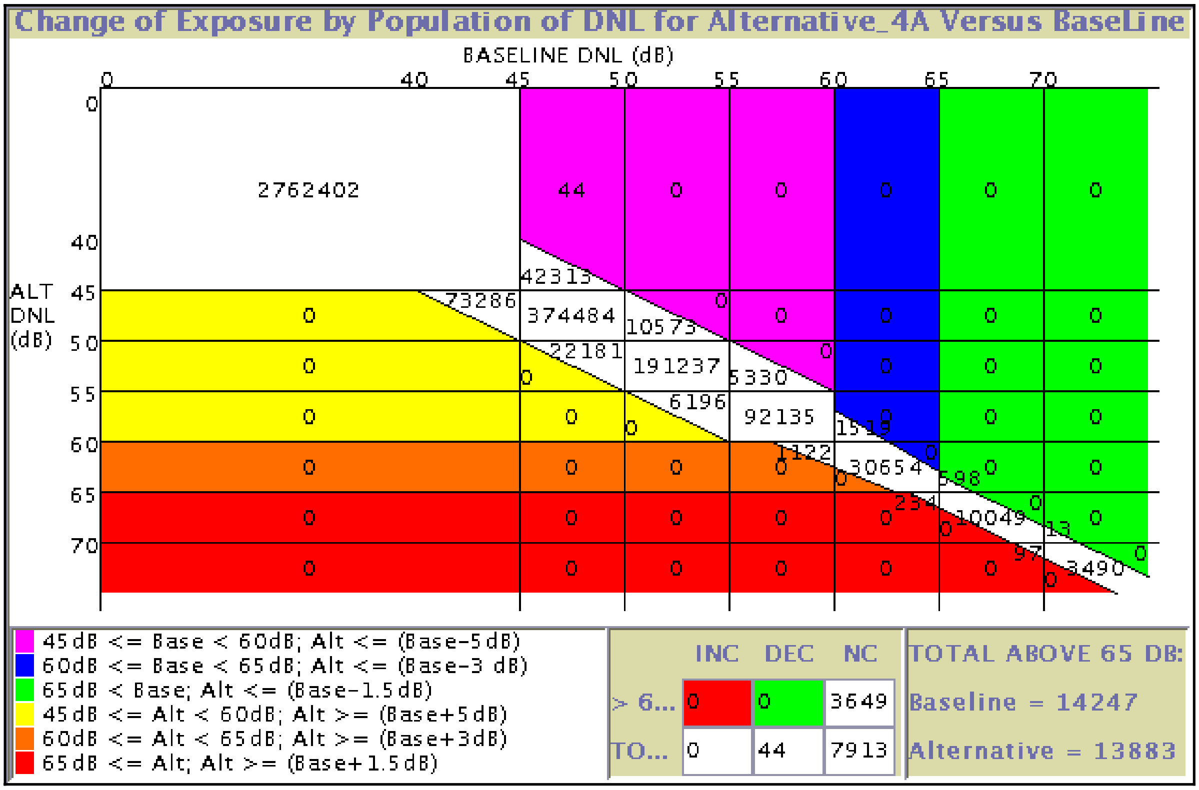


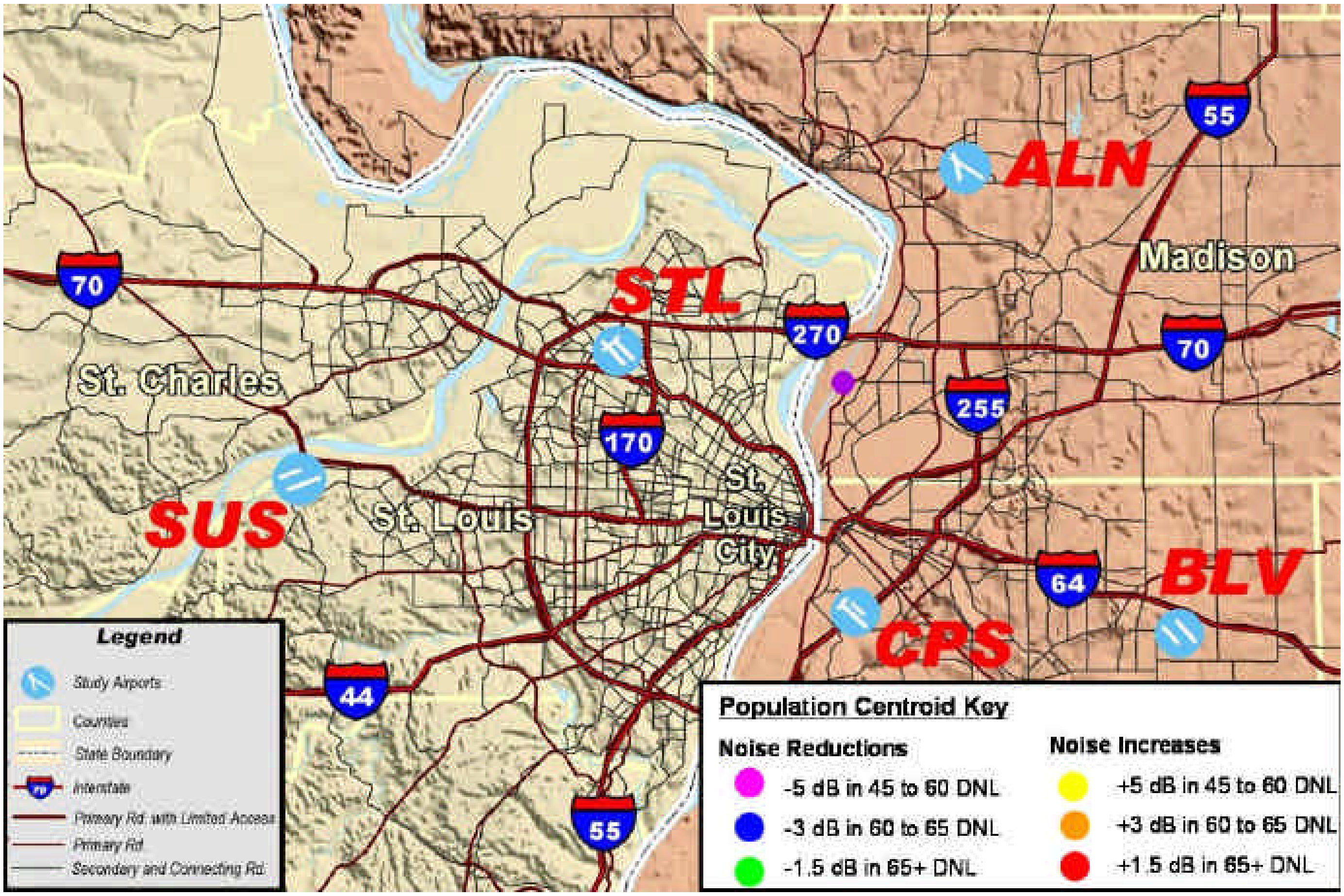
EXHIBIT E-15 NIRS IMPACT GRAPH ALTERNATIVE 4A 2013
(SEE EXHIBIT E-9 FOR DESCRIPTION OF FIGURE FORMAT)

Exhibit E-16 presents a map of the Alternative 4A noise changes for both 2006 and 2013. Only the non-zero population centroids are shown where the noise exposure changed in such a way that it met the noise threshold criteria discussed in the previous sections. Both increases and decreases in noise levels meeting the criteria are shown. The centroids are color coded to identify the criterion that they meet and whether the noise increased or decreased.

As the exhibit indicates, there are no population centroids where the noise levels increased based on the FAA criteria in either 2006 or 2013. The single purple centroid in the exhibit identifies a location where there was a decrease in noise of 5 DNL or more resulting from the alternative procedures in both future years. In 2006 the centroid represents a population of 45 persons and is expected to represent 44 persons by 2013. The centroid lies just east of the Mississippi River and slightly south of I-270. This is an area where the Alternative 4A procedures result in some departure routes being shifted away due to new air traffic sector boundaries.

EXHIBIT E-16

CHANGE IN NOISE AT POPULATION CENTROIDS - ALTERNATIVE 4A VS FUTURE BASELINE 2006 & 2013



E-4.3 Alternative 6

The future Alternative 6 conditions for 2006 and 2013 were modeled in NIRS. Again, the Alternative 6 scenario includes traffic using the new W1W runway that is currently under construction, as well as the airspace design changes identified for the alternative.

Alternative 6 Noise Model Input

STL – Arrivals

There are two main components for the changes to STL arrivals in Alternative 6. First, each short-fix arrival stream from Future baseline is split into dual arrival streams for Alternative 6. This is an effort to increase the arrival efficiency of the airspace. Second, the altitudes of the long-fix arrivals are substantially increased throughout their paths to STL. This allows departures to be less restricted in their climb out of the TRACON area, particularly in areas near the airport. Details of the Alternative 6 changes are described as follows:

- In east flow, the LORLE and KAYLA arrival corner posts are split into two gates.

- In east flow, traffic entering through the PETTI corner post in the northeast or through the QBALL corner post in the southeast remains in the same position, but increases in altitude. Jets cross the posts at 17,000 feet MSL and props enter at 11,000 feet MSL. In Future baseline, jets entered at 15,000 feet MSL and props entered at 8,000 feet MSL. Additionally, long-fix arrival traffic for Alternative 6 stays higher, at or above 11,000 feet MSL, until it is within 7 NM of STL. In Future baseline, traffic was only required to be at or above 7,000 feet MSL at this location.

- In west flow, the PETTI and QBALL arrival corner posts split into two gates.

- In west flow, traffic entering through the LORLE corner post in the northwest or through the KAYLA corner post in the southwest remains in the same position, but increases in altitude. The altitude changes are analogous to those described above for the east flow long-fix arrivals of PETTI and QBALL.

Creating the NIRS model inputs for Alternative 6 arrivals involved moving Future baseline backbones, in terms of both lateral position and altitude. The moves were mainly lateral positional for short fixes, although there was a slight adjustment made to move one short-fix post 1,000 feet lower than its dual counterpart. Long-fix moves were mainly vertical in nature, although a lateral positional change was required nearer the airport. **Exhibit E-17** displays the east flow Alternative 6 STL arrival backbones in red on top of the Future baseline backbones in blue. Yellow arrows indicate the lateral positional moves, and the lightly shaded areas represent regions where altitudes were raised. As depicted by the four yellow arrows nearest the airport, the higher long-fix arrival streams demand longer downwind and final approach legs to give the aircraft time to descend to ground. It was determined that some additional distance would be needed for descent from the beginning of the downwind leg to the final approach segment. This means that the base leg for each long-fix arrival was pushed away from the airport as compared to it's Future baseline position. West flow backbones are not exhibited as the concepts are similar with the fix roles are reversed. PETTI and QBALL become the short-fix arrivals, and KAYLA and LORLE become the long-fix arrivals.

STL – Departures

There are also two major components to the changes to STL departures for Alternative 6. First, the increase in arrival altitudes allows most departures to climb in an unrestricted way, essentially removing the hold downs near the airport seen in the Future baseline condition. Second, the two departure sector scheme of Future baseline is changed to a four sector scheme for Alternative 6. Both these components are designed to improve the efficiency of the departure airspace.

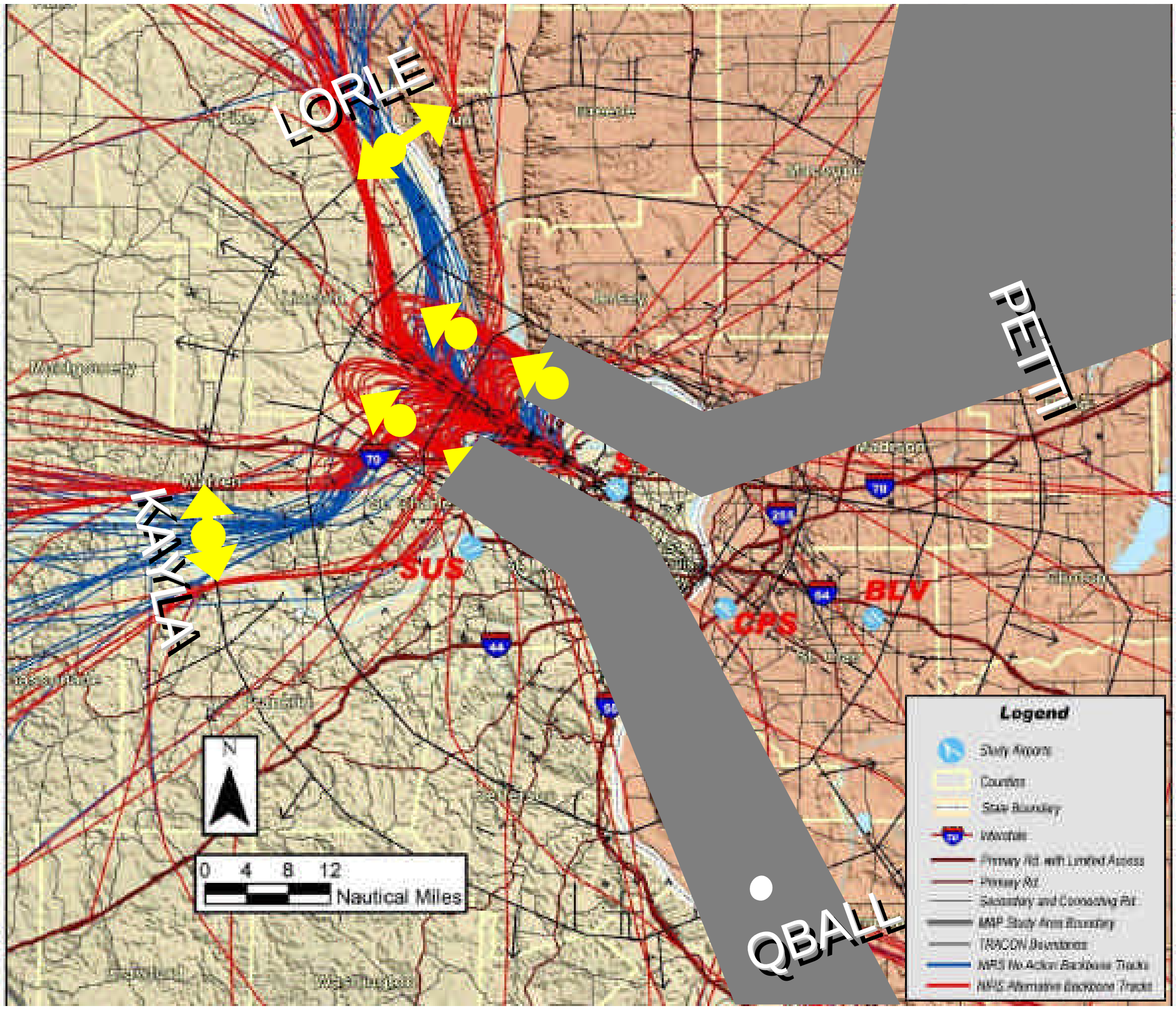


EXHIBIT E-17 ALTERNATIVE 6 ARRIVAL CHANGES - STL

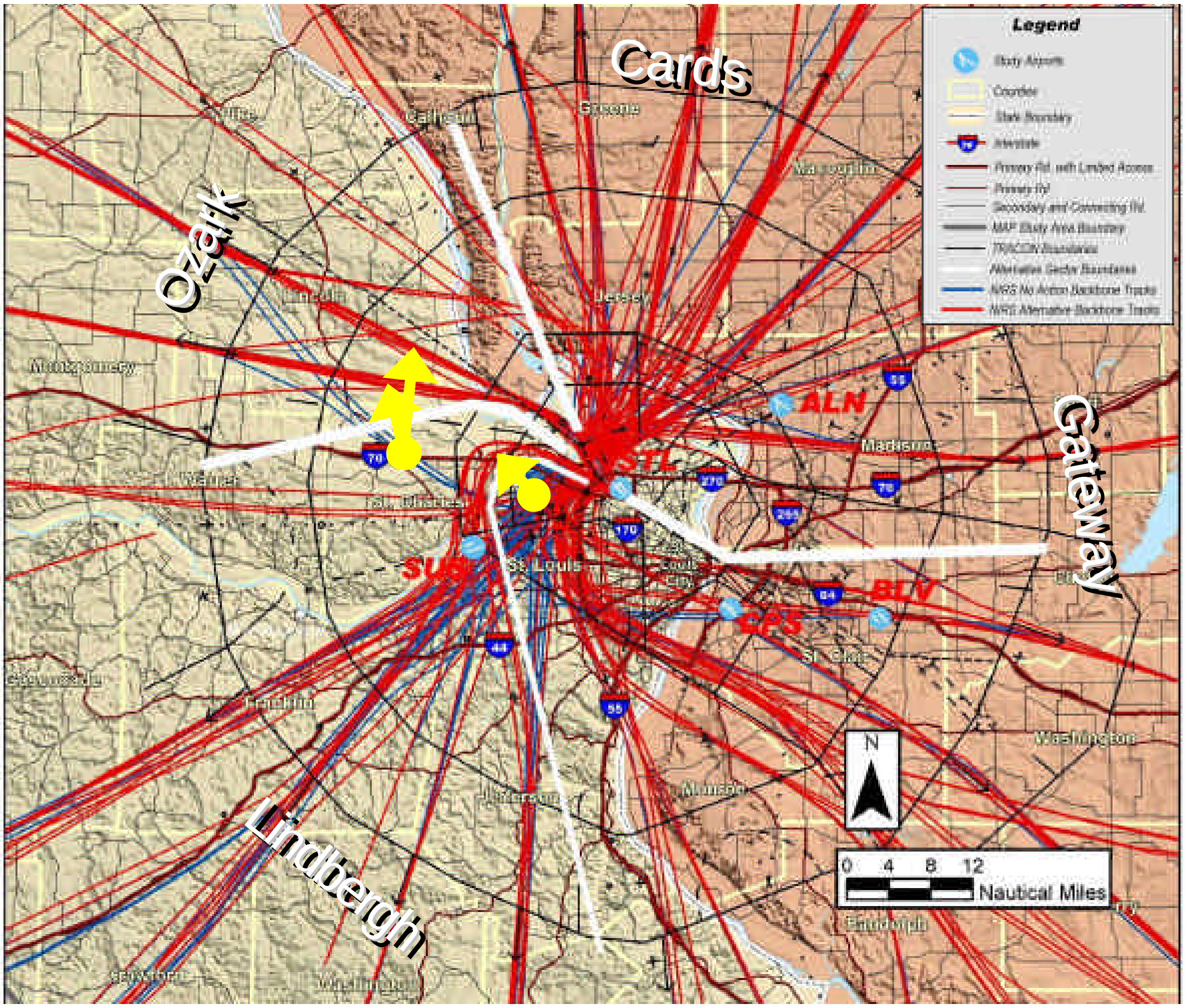


EXHIBIT E-18 - ALTERNATIVE 6 DEPARTURE CHANGES - STL

Satellite – Arrivals

Alternative 6 changes the arrivals to satellite airports in two ways. First, certain flights can now make use of arrival corner posts that have been split for dual arrival streams to STL. Second, Future baseline arrivals that flew over the top of the STL airport will now be routed around STL. These changes have the following specific effects:

- Some ALN and CPS traffic entering the study area in the south shifts east to enter through the changed southeast arrival gate.
- Some ALN traffic from the southwest and some SUS traffic from the northeast must be rerouted so not to fly over the top of STL. Both routes shift in a way to fly around the south side of STL.

Satellite – Departures

Satellite departures are largely unchanged by Alternative 6. The only change necessary was to reroute ALN departures that crossed over STL airport. These departures, bound for gates to the southwest, are moved to take a route around the north side of STL.

Alternative 6 Noise Results

The route and procedural changes associated with Alternative 6 result in a decrease of 34,869 persons exposed to noise levels of 45 DNL or greater in 2006. By 2013, Alternative 6 is only expected to further decrease the estimated people exposed to aircraft noise above 45 DNL by 57,910 persons below that of the Future baseline conditions. Within 65 DNL and greater, a population decrease of 44 persons is expected in 2006 while a slight increase of 399 persons is evident in 2013 over the Future baseline scenario. The detailed analysis indicates that 88 percent of the population exposed to aircraft noise of 45 DNL or greater would experience similar (less than 1 DNL change) or decreased noise levels throughout the study area with Alternative 6 in 2006. That percentage is expected to hold in 2013. **Table E-11** presents a summary of the population exposed to noise levels for Alternative 6 as compared to the Future baseline scenario for both future years.

TABLE E-11 MAXIMUM POTENTIAL POPULATION CHANGE - ALTERNATIVE 6

	Increase		No Change			Decrease
		2006 Future baseline				
	DNL (dB)	<45	45-60	60-65	>65	Alternative
2006 Alternative	<45	2,745,948	73,963	0	0	2,819,911
	45-60	39,094	624,361	1,219	0	664,674
	60-65	0	364	29,990	417	30,771
	>65	0	0	373	13,178	13,551
	Future baseline Total	2,785,042	698,688	31,582	13,595	3,528,907
		2013 Future baseline				
	DNL (dB)	<45	45-60	60-65	>65	Alternative
2013 Alternative	<45	2,787,601	106,179	0	0	2,893,780
	45-60	48,087	638,491	1,540	0	688,118
	60-65	0	945	30,477	173	31,595
	>65	0	0	390	14,074	14,464
	Future baseline Total	2,835,688	745,615	32,407	14,247	3,627,957

Source: NIRS Analysis, Landrum & Brown/Metron Aviation Inc. 2005

The analysis to determine the changes in noise exposure associated with Alternative 6 was developed based on the FAA's noise impact criteria. **Exhibit E-19** presents the NIRS impact graph based on the FAA scoring criteria for the 2006 conditions. Similarly, **Exhibit E-20** presents the Alternative 6 impact graph for the 2013 conditions

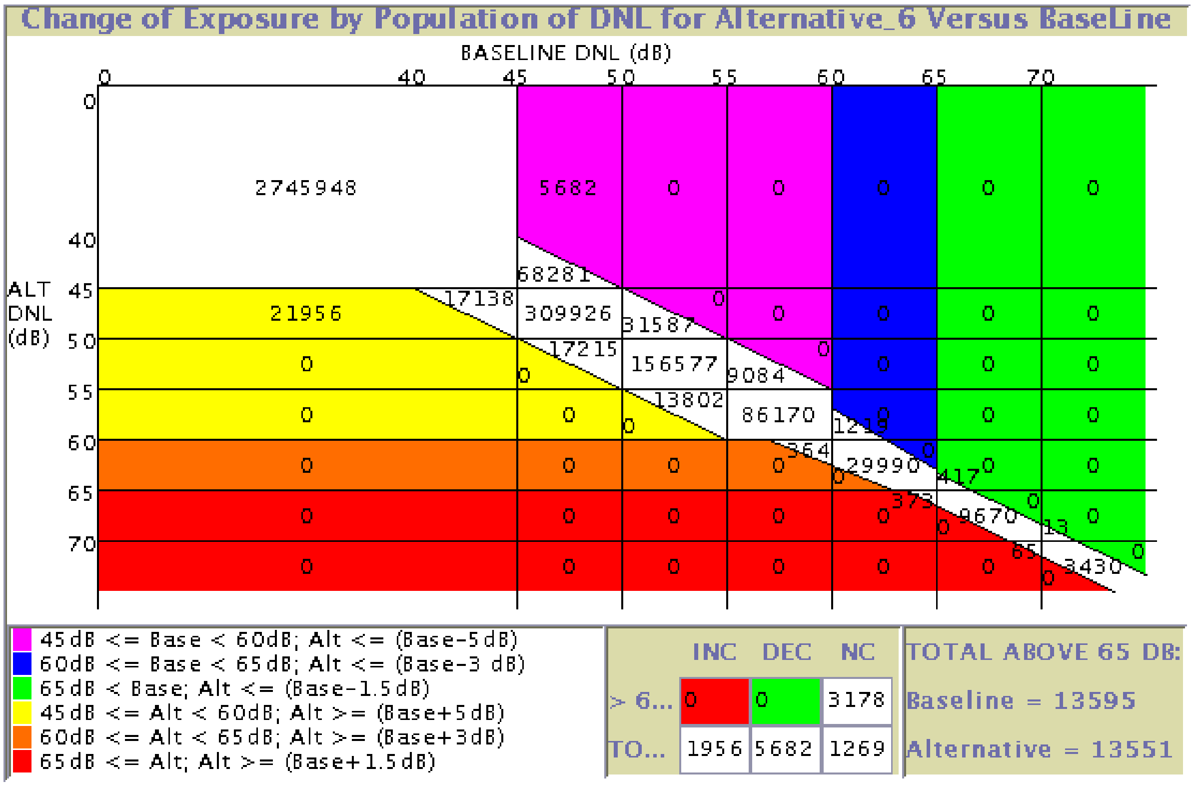


EXHIBIT E-19 NIRS IMPACT GRAPH ALTERNATIVE 6 2006
(SEE EXHIBIT E-9 FOR DESCRIPTION OF FIGURE FORMAT)

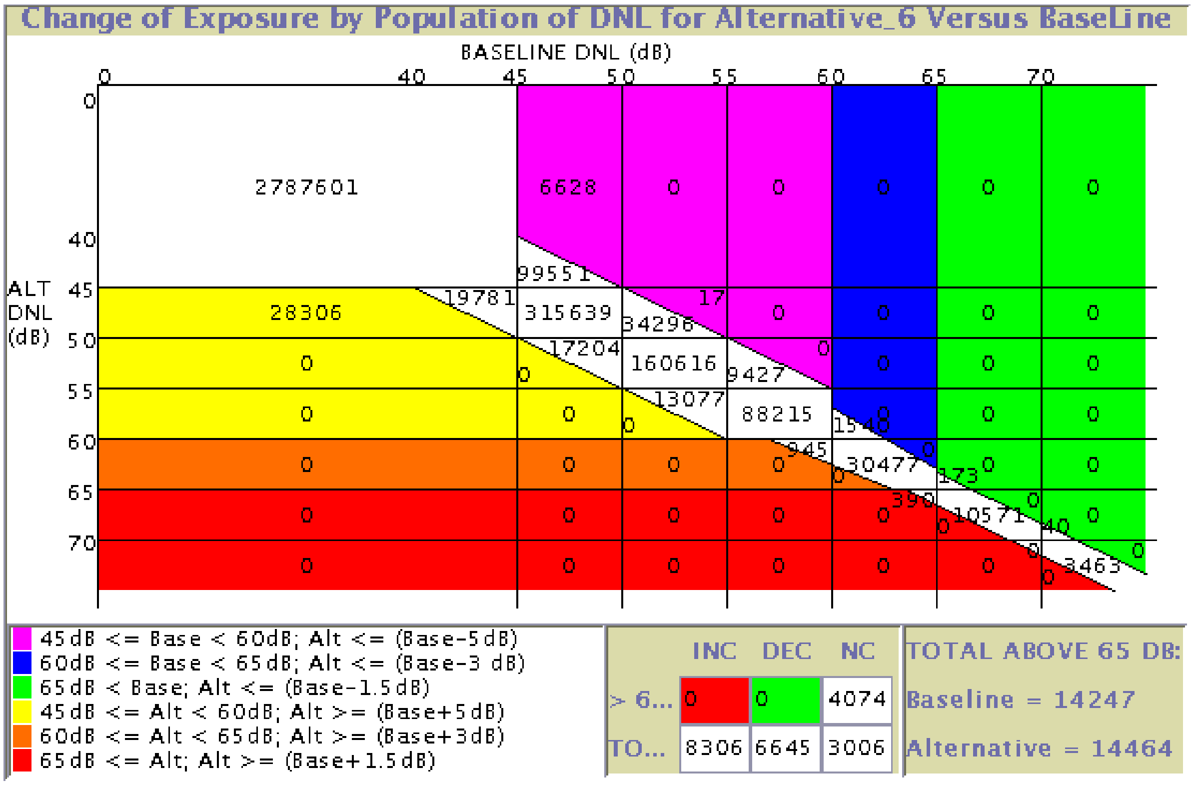


EXHIBIT E-20 - NIRS IMPACT GRAPH ALTERNATIVE 6 2013
(SEE EXHIBIT E-9 FOR DESCRIPTION OF FIGURE FORMAT)

Exhibit E-21 presents a map of the Alternative 6 noise changes for 2006 based on the FAA criteria of significance. Only the non-zero population centroids are shown where the noise exposure changed in such a way that it met the noise thresholds discussed in the previous section. Both increases and decreases in noise levels meeting the criteria are shown. The centroids are color coded to identify the criterion that they meet and whether the noise increased or decreased.

As the exhibit indicates, there are both areas of noise increase (yellow centroids) and noise decrease (purple centroids) resulting from the Alternative 6 changes. The yellow centroids represent where the alternative increased the noise exposure by 5 DNL in an area of 45 to 60 DNL. There are 186 yellow centroids, representing a population of 21,956 persons in 2006, clustered in an area along I-70 near St. Peters, MO. A smaller of cluster of 47 purple centroids, representing 5,637 persons, are clustered just south of I-70 and immediately west of the Missouri river near St. Charles. There is also a single purple centroid representing 45 persons located just east of the Mississippi River in the same location as described for Alternative 4A. These purple centroids represent an area where the alternative decreased the noise exposure by 5 DNL in an area of 45 to 60 DNL. These two clusters of centroids are located in an area where the Alternative 6 procedures result in some departure routes being shifted further west due to new air traffic sector boundaries. This shift is responsible for moving noise away from the area of the purple centroids and into the area where the yellow centroids are located.

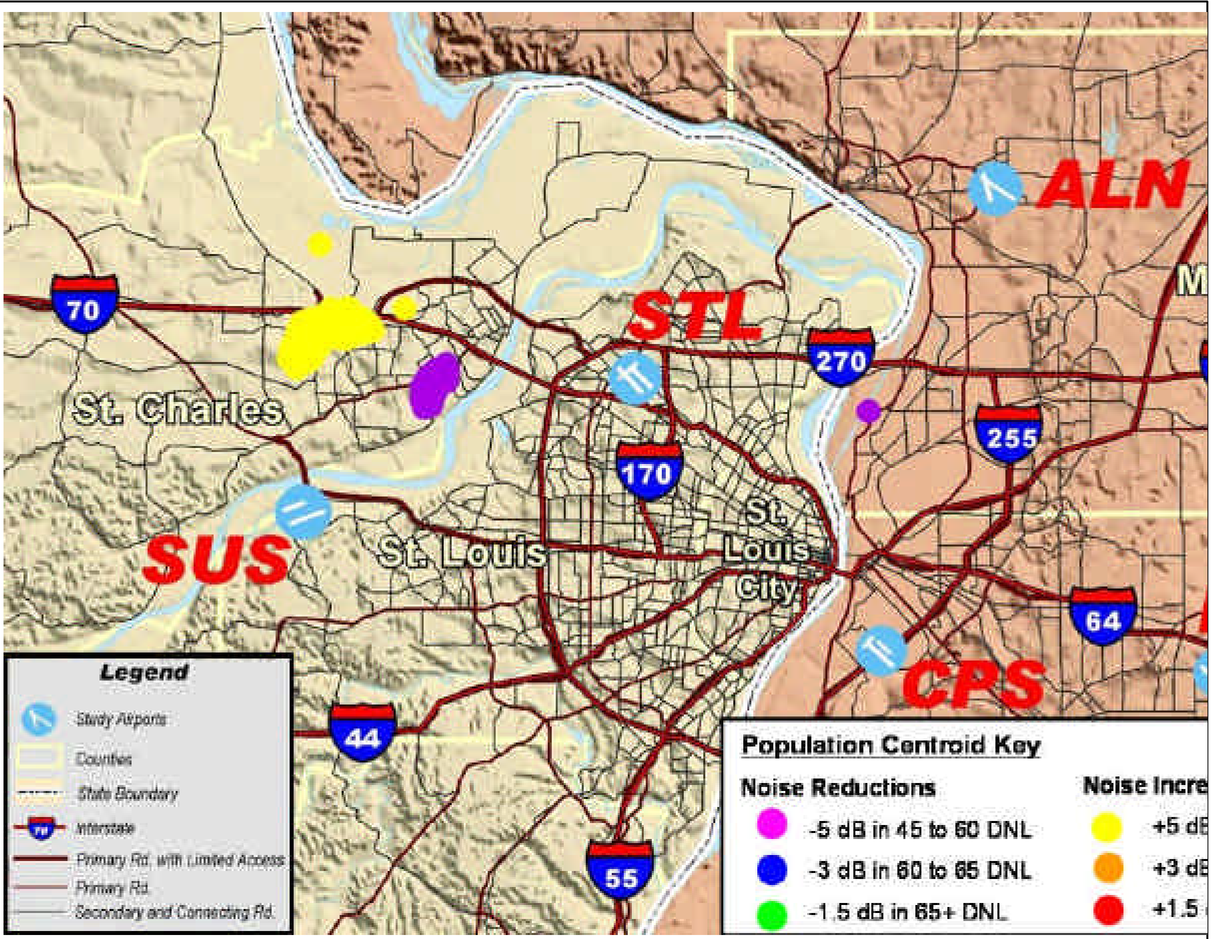


EXHIBIT E-21 CHANGE IN NOISE AT POPULATION CENTROIDS ALTERNATIVE 6 VS FUTURE

Exhibit E-22 presents a similar map of the Alternative 6 noise changes for 2013 based on the FAA criteria of significance. As the exhibit indicates, a similar pattern of noise increases and decreases is evident from the Alternative 6 changes in 2013. In 2013, there are 209 yellow centroids, representing a population of 28,306 persons clustered in the area along near St. Peters, MO. The smaller cluster of 50 purple centroids in 2013 represent 6,601 persons are located just south of St. Charles. Also, there is the single purple centroid representing 44 persons located just east of the Mississippi River in the same location as described for Alternative 4A. Again, the two clusters of centroids are evident of the Alternative 6 procedures that shift some departure routes further west due to new air traffic sector boundaries.

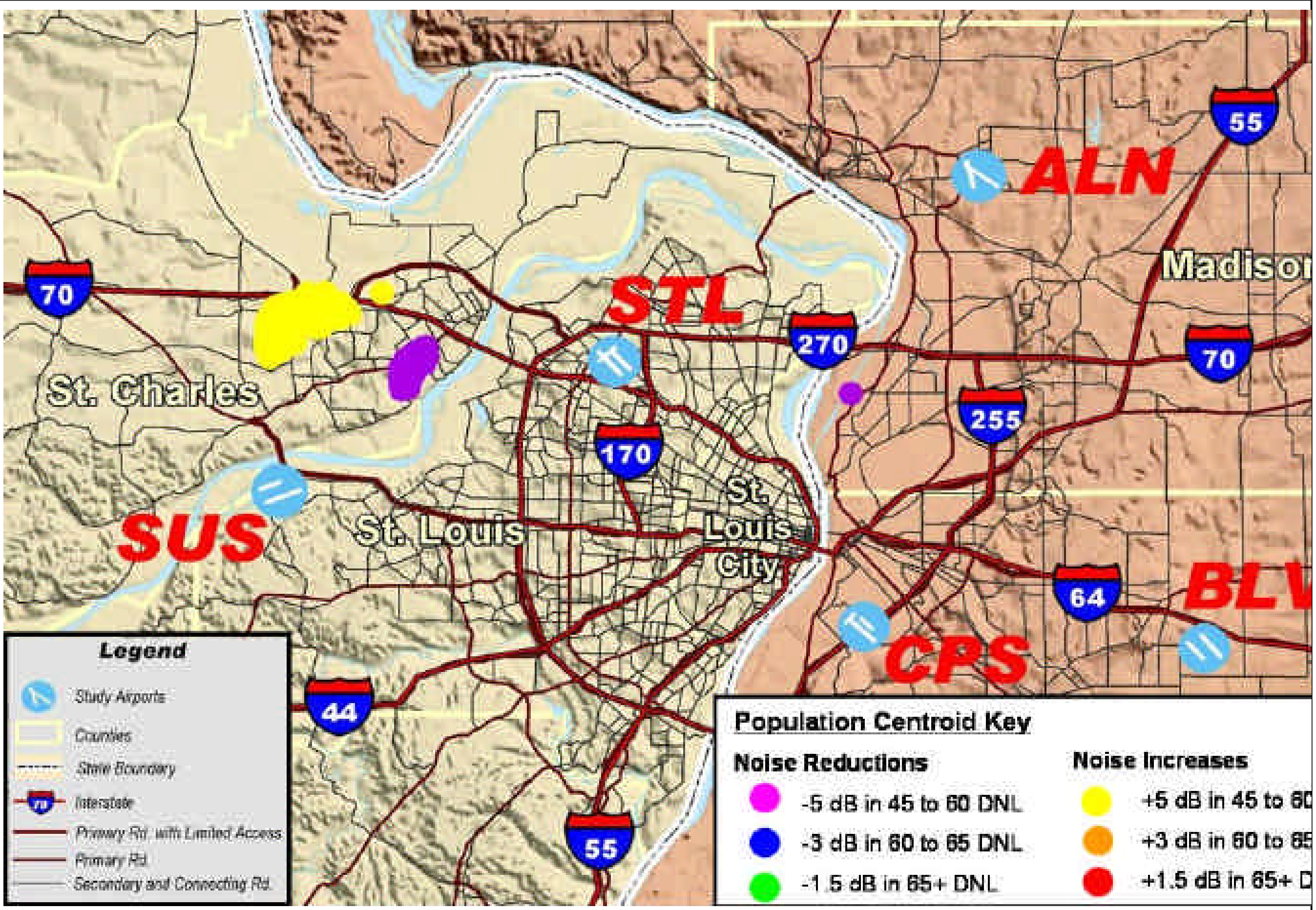


EXHIBIT E-22

CHANGE IN NOISE AT POPULATION CENTROIDS ALTERNATIVE 6 VS FUTURE BASELINE 2013

E-4.4 Alternative 10

The future Alternative 10 conditions for 2006 and 2013 were modeled in NIRS. Again, the Alternative 10 scenario includes traffic using the new W1W runway that is currently under construction, as well as the airspace design changes identified for the alternative.

Alternative 10 Noise Model Input

STL – Arrivals

The main effect of Alternative 10 on STL arrivals is the increase in altitudes of the long-fix arrival streams. Like Alternative 6, this change is intended to improve efficiency, allowing departures a less restricted climb out of the TRACON area. Additionally two direct changes in lateral position of arrival streams are incorporated. The details are as follows:

- Long-fix jet arrivals are designed to enter the TRACON at 15,000 feet MSL, the same as Future baseline. However, they are only allowed to descend to 9,000 feet MSL until they near the airport, whereas Future baseline jets could descend to 7,000 feet. Long-fix prop arrivals enter at 9,000 feet MSL and must remain at 9,000 feet. Future baseline props entered at 8,000 feet and could descend to 7,000 feet.

- The LORLE corner post in the northeast is moved approximately 6.5 NM east.

- The SPI arrival stream exclusively flown by props in the northeast is rerouted during east flow. Alternative 10 flights enter the TRACON approximately 28 NM west of their Future baseline entrance gate.

Model inputs were developed for Alternative 10 arrivals by changing both the lateral positions and the altitudes of affected Future baseline backbones. **Exhibit E-23** shows the east flow arrivals to STL. Alternative 10 backbones are shown in red on top of the Future baseline backbones in blue. Yellow arrows indicate the lateral position changes, and shaded areas indicate areas of altitude change. As depicted by the four yellow arrows nearest the airport, the higher long-fix arrival streams require longer downwind and final approach legs to give the aircraft time to descend. West flow backbones are not exhibited as the concepts are similar, but the fix roles are reversed. PETTI and QBALL become the short-fix arrivals, and KAYLA and LORLE become the long-fix arrivals.

STL – Departures

Alternative 10 incorporates multiple changes in departures at STL, all designed to improve efficiency. A dynamic three departure sector scheme is developed in which one sector boundary can be temporarily moved in west flow to accommodate a heavy traffic push to the east. Multiple departure gates are created or shifted, and climb restrictions are relaxed because of the increase in altitudes of the long-fix arrivals. The details are as follows:

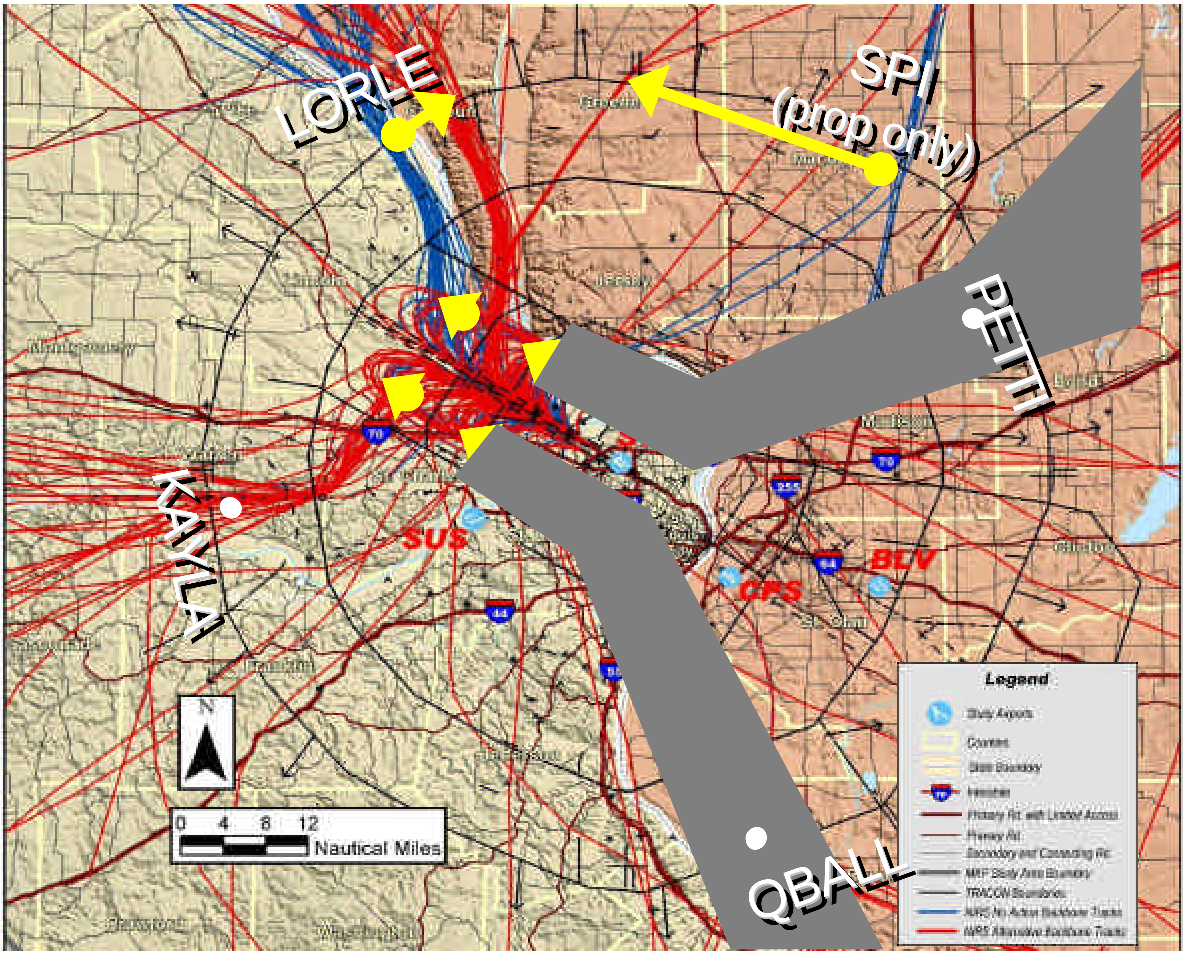


EXHIBIT E-23 ALTERNATIVE 10 ARRIVAL CHANGES - STL

- Three departure sectors are incorporated in Alternative 10, as opposed to the two sectors in Future baseline. The new east flow sectors have little effect on the routing of departures, but there are changes introduced in west flow. First, Ozark jet routes in the northwest switch from an initial heading of 335° to a heading 305° giving them a more direct route to their gate. Blues and Pless departures to the southeast predominantly make the opposite heading switch from a 305° to a 335° taking them around the north side of the airport. However, in a heavy traffic push to the east, the sector boundary in the southeast temporarily changes. Blues and Pless revert to a 305° heading and take the southern route around the airport. It was determined that 15% of Blues and Pless jets would make this swap to the southern route.

- Two new departure procedures are added. The Ozark Kirksville procedure to the northwest receives some traffic from Cards and Ozark gates. The Ramms Naab procedure to the east is a formalization of a shortcut route flown occasionally today. It receives the future baseline traffic flying the shortcut, and receives some traffic from the Gateway procedure just north of Ramms Naab.

- The Blues departure procedure to the southeast moves south approximately 2.5 NM at the TRACON boundary.

- Two Cards departure gates in the north are moved. Cards Neens moves approximately 3 NM east at the TRACON boundary. Cards Bradford moves approximately 2.5 NM east at the TRACON boundary.

- There is no longer a need to hold down departures below 6,000 feet MSL. They are allowed to climb to 8,000 feet until clear of the long-fix arrival streams. This essentially allows them to climb unrestricted.

Creating model inputs for Alternative 10 STL departures involved moving the lateral positions of Future baseline backbones, redistributing traffic to new or modified departure procedures, and transferring traffic from backbones with hold down procedures to backbones with unrestricted climbs. **Exhibit E-24** shows the Alternative 10 west flow departure backbones in red on top of the Future baseline backbones in blue. Yellow arrows indicate the major lateral positional moves and redistributions of traffic. Alternative 10 sector boundaries are depicted in white. In the southeast, only one of the two sector boundaries applies at any given time. During a heavy eastern departure push, the more northern boundary applies as Blues and Pless departures take the southern route to their respective gates. Otherwise, the more southern boundary applies with Blues and Pless taking the northern route. The double-sided yellow arrows indicate this duality.

Satellite – Arrivals

Arrivals to satellites are only slightly changed by Alternative 10. The changes that are necessary are related to the changed positions of corner posts discussed for STL arrivals.

- For ALN and BLV, arrivals entering from the northwest are moved so that they enter through the shifted arrival post.

- For CPS, a portion of the prop traffic entering via the SPI route discussed for STL must shift southward.

Satellite – Departures

Some departures from satellite airports are changed in Alternative 10, because of the creation of new departure gates and the shifting of others. The specific changes are as follows:

- OZKIR is a new gate in the northwest for BLV, CPS, and SUS.

- RAAMS is a new gate in the east for CPS and SUS.

- The BLUES gate moves southward for departures from BLV, CPS, and SUS.

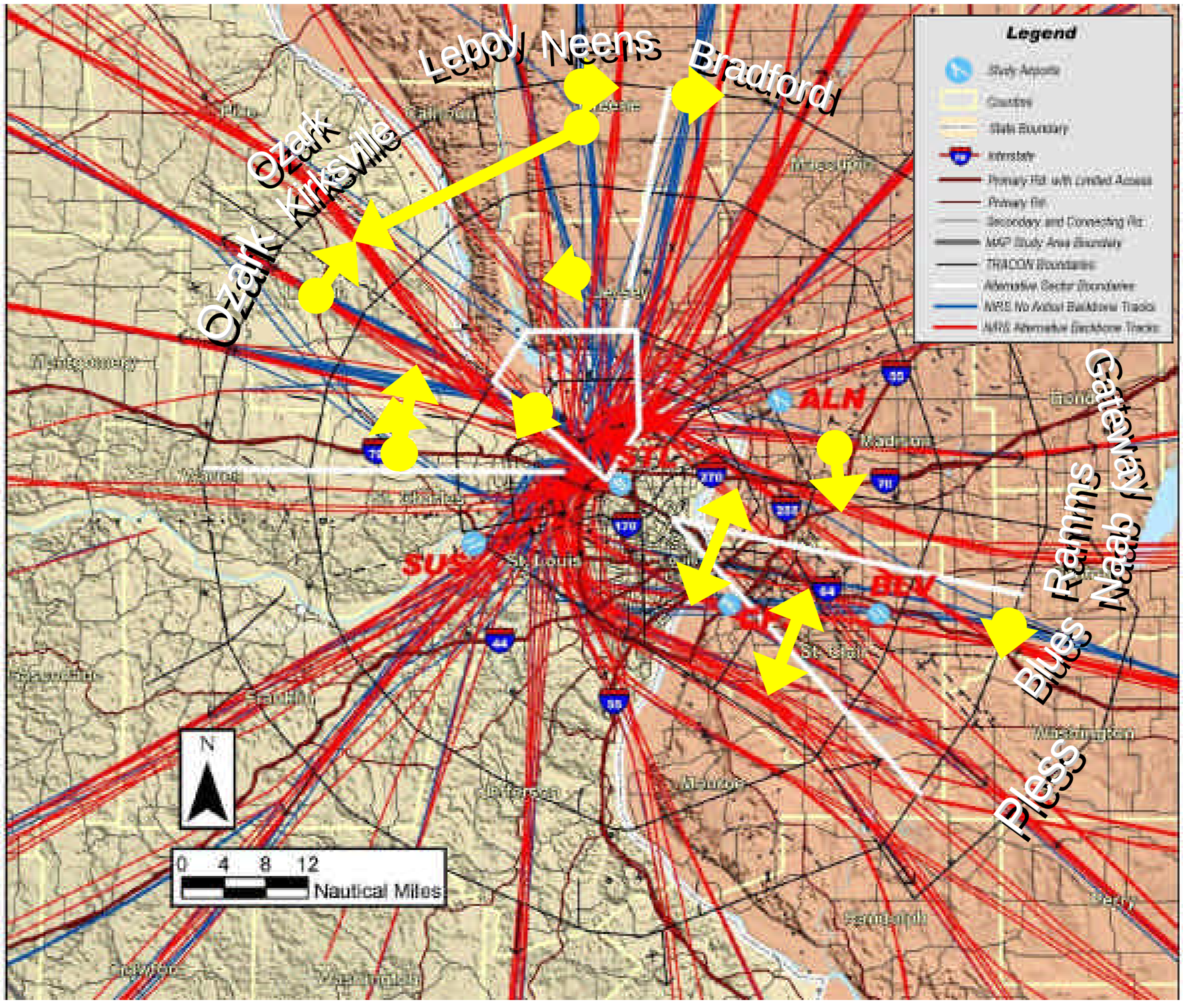


EXHIBIT E-24 ALTERNATIVE 10 DEPARTURE CHANGES – STL

Alternative 10 Noise Results

The route and procedural changes associated with Alternative 10 result in increase of 4,883 persons expected to be exposed to noise levels of 45 DNL or greater in 2006. By 2013, however, Alternative 10 is expected to decrease the estimated people exposed to aircraft noise above 45 DNL to by approximately 8,280 people below the level of the Future baseline conditions. Within 65 DNL and greater, a population decrease of 701 people is expected in 2006 with a decrease of 467 people expected in 2013 below the Future baseline scenario. The detailed analysis indicates that 95 percent of the population exposed to aircraft noise of 45 DNL or greater would experience similar (less than 1 DNL change) or decreased noise levels throughout the study area with Alternative 10 in 2006. That percentage is expected to hold at 94 percent by 2013. **Table E-12** presents a summary of the population exposed to noise levels for Alternative 10 as compared to the Future baseline scenario for both future years.

TABLE E-12 MAXIMUM POTENTIAL POPULATION CHANGE - ALTERNATIVE 10

	Increase		No Change			Decrease
	2006 Future baseline					
	DNL (dB)	<45	45-60	60-65	>65	Alternative
2006 Alternative	<45	2,750,753	29,406	0	0	2,780,159
	45-60	34,289	668,138	1,880	0	704,307
	60-65	0	1,144	29,693	710	31,547
	>65	0	0	9	12,885	12,894
	Future baseline Total	2,785,042	698,688	31,582	13,595	3,528,907
	2013 Future baseline					
	DNL (dB)	<45	45-60	60-65	>65	Alternative
2013 Alternative	<45	2,799,104	44,864	0	0	2,843,968
	45-60	36,584	699,466	1,572	0	737,622
	60-65	0	1,285	30,692	610	32,587
	>65	0	0	143	13,637	13,780
	Future baseline Total	2,835,688	745,615	32,407	14,247	3,627,957

Source: NIRS Analysis, Landrum & Brown/Metron Aviation Inc. 2005

The analysis of the changes relative to FAA's noise impact criteria found that there were no changes resulting from Alternative 10, in either 2006 or 2013 that met the thresholds stated in the scoring criteria. Thus, there are no changes at population centroids to map. **Exhibits E-25 and E-26** presents the NIRS impact graph based on the FAA scoring criteria for the 2006 and 2013 conditions respectively.

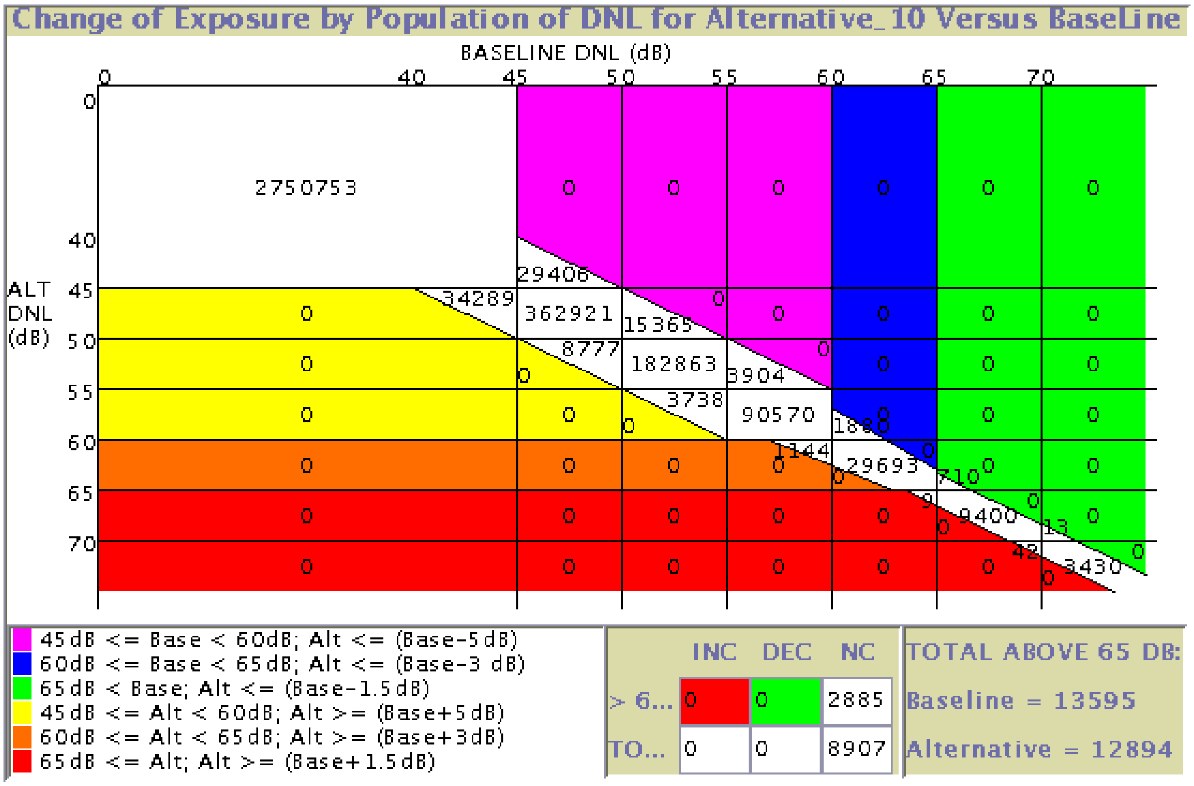


EXHIBIT E-25 NIRS IMPACT GRAPH ALTERNATIVE 10 2006
(SEE EXHIBIT E-9 FOR DESCRIPTION OF FIGURE FORMAT)

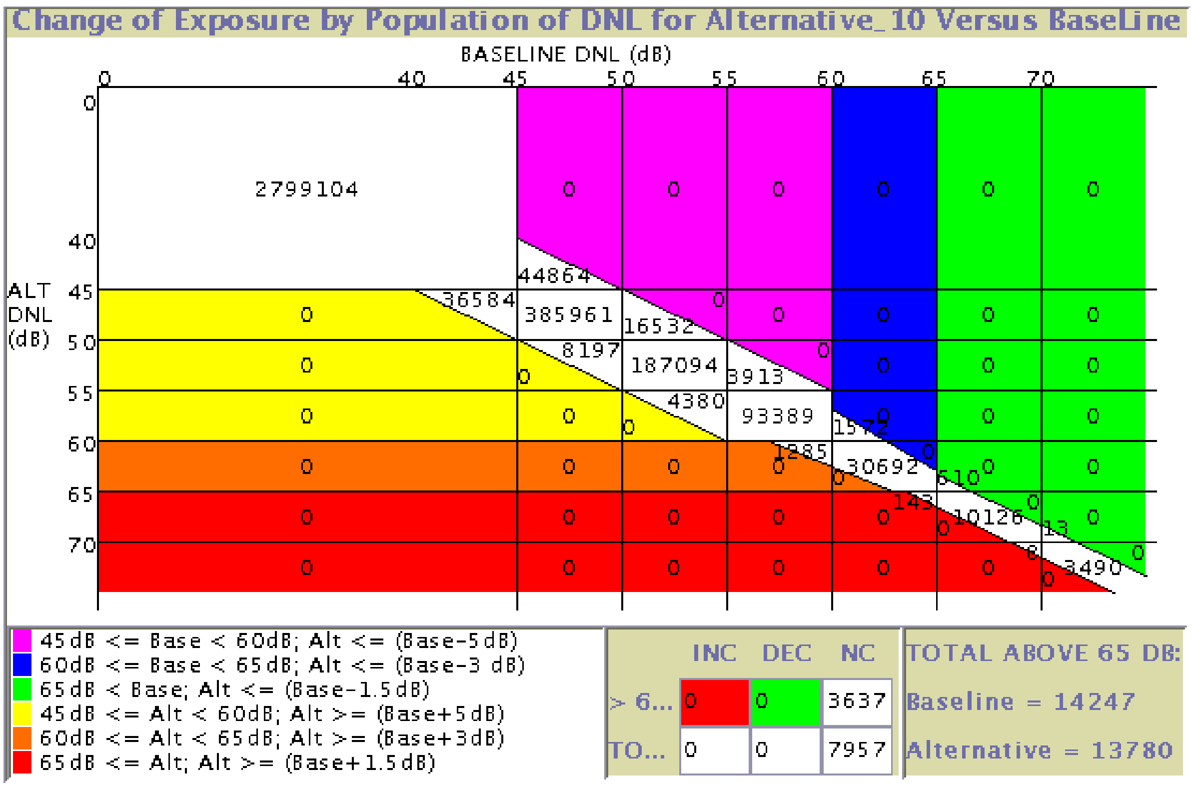


EXHIBIT E-26NIRS IMPACT GRAPH ALTERNATIVE 10 2013
(SEE EXHIBIT E-9 FOR DESCRIPTION OF FIGURE FORMAT)

E.5 AMBIENT NOISE COMPARISON

In addition to the noise modeling analysis presented in the previous section, the noise measurement data presented in **Appendix C, Noise Measurements**, was analyzed in conjunction with the noise modeling computations for each of the 20 noise measurement sites in the study area. This analysis was conducted in order to provide a general understanding of the effects of the proposed MAP alternatives at each location. By including the measured noise along with the modeled changes for each alternative, an estimation of each alternative's contribution to the total noise picture at each site is possible. Accordingly, aircraft noise from modeled aircraft operations, as well as all other aircraft operations can be considered. While this type of analysis can only be done specific to each noise measurement location, it does provide some insights as to the MAP alternatives contribution to the total noise in the area.

The noise levels measured at each of the 20 noise measurement sites contains contributions from all noise sources, including both aircraft and non-aircraft noise events. The NIRS model was used to identify the expected DNL noise levels associated with the IFR flight planned flights to and from the five MAP study airports for the Future baseline conditions. **Table E-13** presents a summary for the measured and modeled noise values for each site

TABLE E-13 COMPARISON OF MEASURED AND MODELED DNL VALUES

Measurement Site	Scenario Measured	2006 Modeled Noise Future baseline	Alt. 4A	Alt 6	Alt 10	2013 Modeled Noise Future baseline	Alt. 4A	Alt 6	Alt 10
01	52.4	28.4	28.2	29.6	27.5	29.0	28.8	30.0	28.1
02	53.2	22.8	31.3	23.7	32.9	22.1	30.3	23.2	31.6
03	53.5	24.8	22.2	24.6	23.5	25.0	22.4	24.7	23.3
04	48.7	37.1	36.5	36.2	39.2	36.6	36.7	36.0	39.0
05	54.9	26.2	25.7	26.2	25.7	27.0	26.6	27.1	26.6
06	54.9	38.7	38.3	38.2	38.6	39.0	38.6	38.5	38.9
07	61.5	40.2	40.5	41.8	42.2	40.5	40.8	41.9	42.3
08	54.4	29.2	26.7	29.2	27.6	23.5	22.8	23.5	24.8
09	50.6	40.6	41.0	40.9	40.9	39.3	39.7	39.7	39.7
10	53.6	41.6	42.1	42.4	41.6	42.3	42.7	42.9	42.2
11	49.3	30.2	35.3	30.3	30.2	31.2	36.4	31.6	31.3
12	63.5	45.5	46.0	45.2	45.2	45.8	46.2	45.5	45.4
13	60.1	47.7	47.8	47.7	47.9	48.2	48.3	48.2	48.3
14	56.3	45.9	45.9	45.8	45.9	46.3	46.3	46.2	46.4
15	62.0	27.7	30.0	26.4	27.8	28.2	30.6	26.8	28.3
16	49.7	34.2	33.8	33.4	34.3	34.5	34.1	33.9	34.6
17	54.1	46.1	45.9	41.6	46.0	46.4	46.1	41.9	46.3
18	58.0	51.5	51.7	53.6	51.5	51.7	51.8	53.8	51.8
19	53.3	37.7	36.0	38.3	36.2	37.6	35.9	38.4	36.1
20	58.3	41.1	38.5	39.3	41.2	41.3	38.9	39.6	41.4

Source: Landrum & Brown Analysis, 2005

The modeled DNL values for the Future baseline scenario were then subtracted from the DNL values measured at each site. The resulting value represents an estimation of the background noise at each site including various noise sources and only the other aircraft activity that was not included in the NIRS modeling. This might include VFR flights traversing the area or traffic from airports not modeled in NIRS. For the purposes of this analysis, these computed background noise levels were assumed to be reasonable estimations of the future background noise levels that might be found at each site in 2006 and 2013.

Once the background noise values were computed for each site, the Modeled DNL values for each of the future conditions (Future baseline and each alternative) were added to the background values. This results in an estimation of the total noise at each site for each future scenario. **Table E-14** presents the results of this computation.

TABLE E-14 COMPARISON OF TOTAL NOISE DNL VALUES (BACKGROUND+MODELED)

Measurement Site	Scenario Calculated Background	2006 Total Noise Future baseline	Alt. 4A	Alt 6	Alt 10	2013 Total Noise Future baseline	Alt. 4A	Alt 6	Alt 10
01	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4
02	53.2	53.2	53.2	53.2	53.2	53.2	53.2	53.2	53.2
03	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5
04	48.4	48.7	48.6	48.6	48.9	48.6	48.6	48.6	48.8
05	54.9	54.9	54.9	54.9	54.9	54.9	54.9	54.9	54.9
06	54.8	54.9	54.9	54.9	54.9	55.0	54.9	54.9	55.0
07	61.4	61.5	61.5	61.5	61.5	61.5	61.5	61.5	61.5
08	54.4	54.4	54.4	54.4	54.4	54.4	54.4	54.4	54.4
09	50.1	50.6	50.6	50.6	50.6	50.4	50.5	50.5	50.5
10	53.3	53.6	53.6	53.6	53.6	53.6	53.7	53.7	53.6
11	49.2	49.3	49.4	49.3	49.3	49.3	49.4	49.3	49.3
12	63.5	63.5	63.5	63.5	63.5	63.5	63.5	63.5	63.5
13	59.9	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.2
14	55.9	56.3	56.3	56.3	56.3	56.3	56.3	56.3	56.4
15	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0
16	49.6	49.7	49.7	49.7	49.7	49.7	49.7	49.7	49.7
17	53.4	54.1	54.1	53.7	54.1	54.2	54.1	53.7	54.2
18	56.9	58.0	58.0	58.5	58.0	58.0	58.1	58.6	58.1
19	53.2	53.3	53.3	53.3	53.3	53.3	53.3	53.3	53.3
20	58.2	58.3	58.3	58.3	58.3	58.3	58.3	58.3	58.3

Source: Landrum & Brown Analysis, 2005

In order to investigate the changes associated with each MAP alternative when all noise sources are considered, the Future baseline total noise levels are subtracted from the total noise levels associated with each alternative in each year. **Table E-15** presents the estimated differences in total noise at each site for each alternative in each of the future years.

TABLE E-15 DIFFERENCE IN TOTAL NOISE DNL VALUES FOR MAP ALTERNATIVES

	Scenario								
Measurement Site	Calculated Background	2006 Future baseline Total Noise	Alt. 4A	Alt 6	Alt 10	2013 Future baseline Total Noise	Alt. 4A	Alt 6	Alt 10
01	52.4	52.4	0.0	0.0	0.0	52.4	0.0	0.0	0.0
02	53.2	53.2	0.0	0.0	0.0	53.2	0.0	0.0	0.0
03	53.5	53.5	0.0	0.0	0.0	53.6	0.0	0.0	0.0
04	48.4	48.7	0.0	-0.1	0.2	48.4	0.0	0.0	0.2
05	54.9	54.9	0.0	0.0	0.0	55.0	0.0	0.0	0.0
06	54.8	54.9	0.0	0.0	0.0	55.0	0.0	0.0	0.0
07	61.4	61.5	0.0	0.0	0.0	61.4	0.0	0.0	0.0
08	54.4	54.4	0.0	0.0	0.0	54.5	0.0	0.0	0.0
09	50.1	50.6	0.0	0.0	0.0	50.8	0.0	0.0	0.0
10	53.3	53.6	0.0	0.1	0.0	53.3	0.0	0.0	0.0
11	49.2	49.3	0.1	0.0	0.0	50.9	0.2	0.0	0.0
12	63.5	63.5	0.0	0.0	0.0	63.6	0.0	0.0	0.0
13	59.9	60.1	0.0	0.0	0.0	60.0	0.0	0.0	0.0
14	55.9	56.3	0.0	0.0	0.0	55.9	0.0	0.0	0.0
15	62.0	62.0	0.0	0.0	0.0	62.0	0.0	0.0	0.0
16	49.6	49.7	0.0	0.0	0.0	51.3	0.0	0.0	0.0
17	53.4	54.1	0.0	-0.5	0.0	55.6	-0.1	-0.5	0.0
18	56.9	58.0	0.0	0.6	0.0	56.9	0.0	0.6	0.0
19	53.2	53.3	0.0	0.0	0.0	53.5	0.0	0.0	0.0
20	58.2	58.3	0.0	0.0	0.0	58.2	0.0	0.0	0.0

Source: Landrum & Brown Analysis, 2005

As the table indicates, the resulting changes in total noise for each alternative confirm that the changes in noise associated with each MAP alternative tend to be very small in the context of the total noise picture for the sites.

Table E-16 presents a summary of the population impacts for each alternative in terms of the FAA threshold criteria. The table is color coded based on the centroid mapping scheme presented in the earlier exhibits. As the analysis indicates, only Alternative 6 creates changes where noise is increased within one of the FAA criterion thresholds. There are some corresponding decreases of similar magnitude evident in Alternative 6, but they occur over fewer persons that did the increases. Alternative 4A provided some very modest noise decreases over a single population point in both future years. There were no notable increases, or decreases in noise exposure resulting from Alternative 10 in either of the future years.

TABLE E-16 MAP ALTERNATIVES POPULATION IMPACT CHANGE ANALYSIS SUMMARY

	DNL Noise Exposure With Proposed Action		
	65 dB or higher	60 to 65 dB	45 to 60 dB
Minimum Change in DNL With Alternative	1.5 dB	3.0 dB	5.0 dB
Level of Impact	Significant	Slight to Moderate	Slight to Moderate
Noise Increases			
2006 Forecast			
Alternative 4A	0	0	0
Alternative 6	0	0	21,956
Alternative 10	0	0	0
2013 Forecast			
Alternative 4A	0	0	0
Alternative 6	0	0	28,306
Alternative 10	0	0	0
Noise Decreases			
2006 Forecast			
Alternative 4A	0	0	45
Alternative 6	0	0	5,682
Alternative 10	0	0	0
2013 Forecast			
Alternative 4A	0	0	44
Alternative 6	0	0	6,645
Alternative 10	0	0	0

Source: NIRS Analysis, Landrum & Brown/Metron Aviation Inc. 2005

Overall, the noise exposure analysis indicates that both Alternative 6 and 10 provide some reductions in the total number of persons exposed to aircraft noise above 45 DNL in 2013 while Alternative 4a creates a modest increase. Alternative 6 also provides some reduction in 2006 when Alternative 10 generates a very small population increase. Alternative 10 is clearly better at reducing the population exposed to aircraft noise greater than 65 DNL in both of the future years. Alternative 4A also provides some minor reductions in the population exposed to noise greater than 65 DNL in the future years while Alternative 6 creates a very slight reduction in 2006 and an increase in 2013.

The modeled noise levels for the Future baseline and each of the MAP alternatives were also analyzed in terms of the ambient background noise present at 20 locations throughout the MAP study area. These locations corresponded to the sites where samples of field noise measurements were taken as part of the MAP study. The measurement data allowed for the consideration of all noise at each site, including aircraft noise resulting from air traffic that was not modeled in the NIRS modeling. The analysis provided a quantitative estimation of the effects of the MAP alternatives at the 20 specific noise measurement locations. |The results revealed that the noise changes associated with the MAP alternatives are very small in the context of the total noise at each site. This quantitative analysis at the 20 locations in the study area provides a basis for the qualitative consideration of the effects MAP alternative changes in terms of background noise levels throughout the study area.